PROCEEDINGS

of the

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THE DISTRIBUTION OF OVERWINTERING TRYPODENDRON (COLEOPTERA, SCOLYTIDAE) AROUND A SINGLE TREE IN RELATION TO FOREST LITTER VARIABILITY[1]

J. A. CHAPMAN[2]

Introduction

The occurrence of overwintering *Trypodendron lineatum* (Oliv.) in forest litter was first reported and studied by Hadorn (1933). Later investigations on the hibernating sites of this ambrosia beetle were made by Kinghorn and Chapman (1959). One of their findings was that the beetles tended to concentrate around the bases of trees.

Examinations of litter in British Columbia have shown that there is often considerable difference in numbers of beetles from similar or adjacent samples. An example of this is given by Chapman (1959). There are many factors which may contribute to forest litter variability; for example, amount of rotten wood or moss, relative contribution from various tree species, moisture, and nature of ground cover. The purpose of the present study was to secure information, within a small sample area, on obvious differences in ground cover and nature of litter in relation to numbers of overwintering beetles.

Method

It was believed that the information desired could best be secured by sampling in such small units that the approximate location of individuals could be determined, in relation to litter variability. Accordingly, in 1959, near Parksville, B.C., some time was spent sampling the litter surrounding a single tree within a stand of timber. The seasonal activity of *Trypodendron* had been studied earlier in adjacent logging settings (Chapman and Dyer, 1960) and the location of a fairly large population of overwintering beetles was known from studies by E. D. A. Dyer and J. M. Kinghorn of this Laboratory. The work was done in November and December, after the beetles were all in their overwintering quarters. The area to be sampled was marked out in 6 by 6 inch squares and, including some smaller units next to the tree, 287 samples were taken. In each square the litter and organic material which could easily be removed by hand from above the mineral soil was taken. Previous work (Kinghorn and Chapman, l.c.) had shown that most if not all of the overwintering population is located above the mineral soil. The portion of the surface covered by leaves of salal (*Gaultheria Shallon* Pursh), the common under-growth plant of the coast forest, was noted, and the amount of moss estimated for each sample. Other obvious features of the litter, as presence of bark flakes in large amounts, or surface roots or fallen branches were also noted and the volume of each sample was measured after examining it for beetles.

Immediately upon collection the samples were placed in individual plastic bags and kept at outdoor temperatures in a shaded location until they were examined, within two months. This was done by spreading the litter thinly on a warm surface under a light (Hadorn's method) and watching it for a period of time judged entirely sufficient to activate all beetles. With this method they are seen easily when they begin to crawl about and at this stage of their life they seldom fly from the warmed

[1] Contribution No. 680, Forest Biology Division, Research Branch, Department of Agriculture, Ottawa, Canada.

[2] Forest Biology Laboratory, Victoria.

litter. The litter was redistributed on the warm surface at intervals during the examination period, to increase search effectiveness. Twelve of the samples which had been stored longest and from which a total of 37 beetles had been taken using the above procedure, were next examined by a wet method which reveals dead insects also (Kinghorn and Dyer, 1960). Only three more beetles were found, giving a recovery of 92 per cent for the warm pan method. This agrees well with previous tests of beetle recovery (Kinghorn and Chapman, l.c.) and is good evidence that few had died in the interval between collection and examination of litter, or were missed by the warm pan method.

Results

The data from this study are best given as a beetle distribution map of the area sampled (Figure 1). In (A) each beetle is represented by a dot. Within any given sample unit the dots have been arranged uniformly. The two squares adjacent to the tree represent 12 x 12 inch samples taken previous to this study. It is obvious that the positions of the beetles are only approximately shown. While most of them are closer, the maximum distance they could be recorded from their true position is 8½ inches (the length of a diagonal of a 6 by 6 inch square). The portion of ground surface covered by salal leaves is shown by the diagonal lines. No distinction was made between low, dense cover and higher, more diffuse cover. The position of a small dead tree which lay across the sample area is also shown, the interrupted lines indicating contact with earth or litter, the solid-lined portion being 2 to 4 inches above the surface.

In (B) the relative abundance of surface moss is indicated by from 2 to 49 dots per sample unit, corresponding to a range of trace amount to 2/3 of the litter sample volume, in 8 steps. The relative volume of litter per sample is also indicated; the range 25-35 cubic inches, to 100-150 cubic inches per sample being shown by use of 0 to 8 horizontal lines per sample square, with five categories. No obvious relationships between numbers of beetles and presence of dead salal leaves, small twigs, shallow roots or other miscellaneous features of the litter were noted.

Discussion

Certain inferences or tentative conclusions may be based on this study. First, there appears to be no direct relationship between moss or litter volume and numbers of beetles. Secondly, although the beetles concentrate next to trees, as earlier reported by Kinghorn and Chapman, a considerable proportion occur over a foot away. Thirdly, two features of the data suggest that surface cover is a significant factor in determining the final position of overwintering beetles: 1) the apparent effect of that part of the small fallen tree lying above the surface in concentrating beetles beneath and close to it (note Fig. 1-A), and 2) the quite marked association between high density of beetles and salal cover on the southeast side of the tree. It is possible that a concentration of large trees 15-20 feet to the southeast resulted in a shading effect which contributed somewhat to the heavier population on that side of the tree. It appears, however, that the primary factor was the salal cover, which in this section of the sample area formed a dense well defined zone, contrasting with an adjacent open space. It should be said that the area of felled logs from which, presumably, most of the beetles came, lies to the north through about 200 feet of timber. Finally, it can be noted that the distribution of

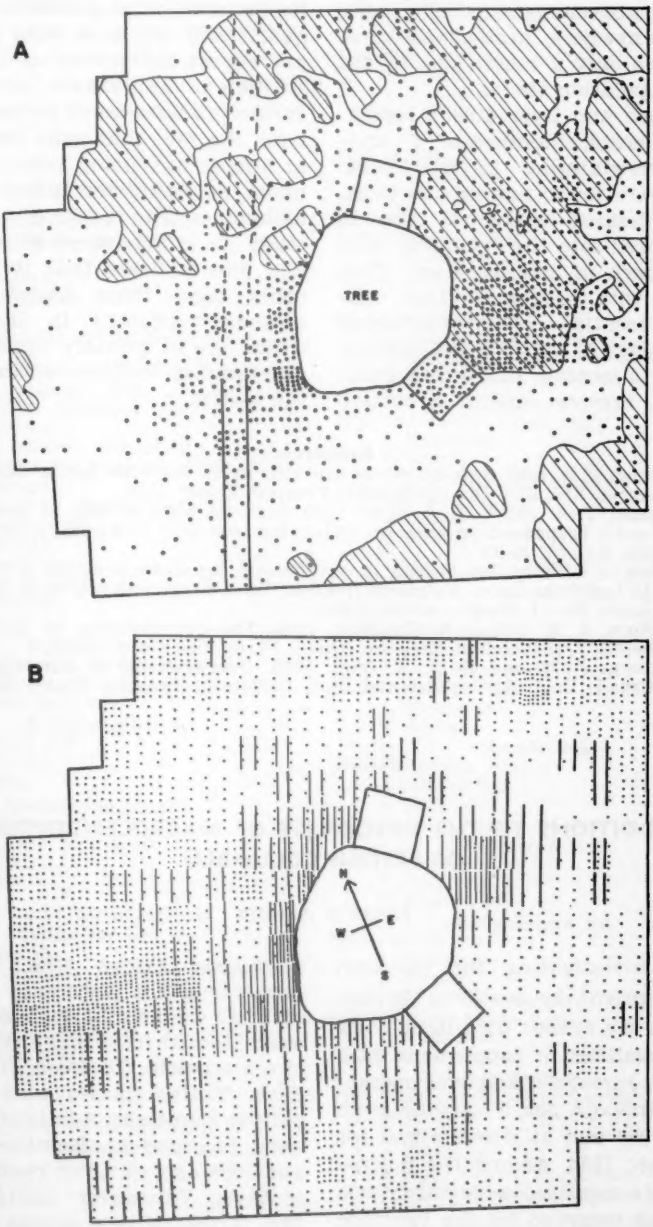

Fig. 1.—(A) Distribution of beetles (dots) around a tree in relation to salal (**Gaultheria**) undergrowth. (B) Relative amounts of moss (dots) and litter in the same area (see text).

beetles, while not random, is certainly variable enough so that a single sample anywhere around the tree would give only a rough idea of the actual population there.

Kinghorn and Dyer (1960) reported considerable numbers of *T. lineatum* overwintering in tree bark. Beetles were found not only in thick, heavily fissured bark, but also in niches bored into the relatively thin, smooth bark of smaller trees. This, together with earlier findings concerning location of overwintering beetles, suggests that it is the physical nature of a location in offering small, protected crevices within a certain general setting which influences a beetle to select its specific hibernating quarters. If this is so, then one would not expect differences in litter composition or appearance, even at the surface, to have much influence apart from the fact that most litter offers, at almost any point, relatively dark, moist, easily entered hiding places in abundance. The results of the present study are in agreement with this view and also indicate that it is factors other than those associated with obvious variations in litter itself which are of primary importance in determining location of overwintering beetles.

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ADDITIONS TO THE CHECK LIST OF MACROLEPIDOPTERA OF BRITISH COLUMBIA[1]

DAVID A. ARNOTT

While investigating the cutworm species present in southern British Columbia the author used light traps at two localities to supplement data from field surveys. A trap was operated at Kamloops for 5 esasons from 1955 to 1959 and at Summerland for one season, 1956. Among the macrolepidoptera captured were thirty-two species not recorded for the Province by Llewellyn-Jones (1951), including *Laphygma exigua* Hbn., the beet armyworm, not previously known to occur in Canada. A single new record was obtained from Summerland, that of a geometrid, *Cheteoscelis bistriaria* Pack. Thirty species were recorded only at Kamloops. Adults of *L. exigua* were recorded at Kamlops in 1956 and 1958 and an adult recorded from southern Vancouver Island in 1958. The larvae of this species were also found during 1958 infesting crops of table beets and tomato at Ladner and tomato at Pavilion.

[1] Contribution No. , Entomology Laboratory, Research Branch, Canada Department of Agriculture, Kamloops, British Columbia.

The arrangement and numbering of species, locality and flight period, conforms with Llewellyn-Jones' list, which mainly follows that of McDunnough (1938) in his "Check List of Lepidoptera of Canada and the United States, Part I".

Family ARCTIIDAE

Subfamily ARCTIINAE

Apantesis Wlk.

1033 virgo L.
1. Kamloops.
2. July, August.

Family NOCTUIDAE

Subfamily NOCTUINAE

Euxoa Hbn.

1236 dargo Stkr. *rumatana* Sm.
1. Kamloops.
2. July, August, September.

1247 olivalis Grt. *mcdunnoughi* Cook.
1. Kamloops.
2. June, July, August, September.

near 1250 maimes Sm.
1. Kamloops.
2. August.

near 1371 servita Sm.
1. Kamloops.
2 July.

Agrotis Ochs.

1425 venerabilis Wlk. Dusky cutworm.
1. Kamloops.
2. August, September.

Amathes Hbn.

1518 substrigata Sm.
1. Kamloops.
2. August.

Anomogyna Staud.

1558 imperita Hbn.
a discitincta Wlk. *arufa* Sm.
1. Kamloops.
2. August.

Subfamily HADENINAE

Trichoclea Grt.

1652 fuscolutea Sm.
1. Kamloops.
2. May.

Ceramica Gn.

1951 picta Harr. *exusta* Gn. *contraria* Wlk. Zebra caterpillar.
1. Kamloops.
2. July.

Subfamily CUCULLIINAE

Lathosea Grt.

2021 pulla Grt. *pullata* Grt.
1. Kamloops.
2. April.

Cucullia Schrank.

2038 intermedia Speyer.
a cinderella Sm.
1. Kamloops.
2. May, July, August, September.

Oncocnemis Led.

2090 augustus Harv.
1. Kamloops.
2. September.

2127 riparia Morr.
a aqualis Grt.
1. Kamloops.
2. July.

Homohadena Grt.

2150 stabilis Sm.
1. Kamloops.
2. July, August.

Brachylomia Hamp.

2209 discinigra Wlk.
1. Kamloops.
2. April, September.

Hillia Grt.

2211 iris Zett. *crasis* H.-S. *semisigna* Wlk. *erdmanni* Moesch. *senescens* Grt.
1. Kamloops.
2. September.

Fishia Grt.

2279 discors Grt. *vinela* Sm.
1. Kamloops.
2. October.

Anathix Franc.

2319 aggressa Sm.
1. Kamloops.
2. August.

Subfamily AMPHIPYRINAE

Archanara Wlk.

2440 subflava Grt.
1. Kamloops.
2. July, August.

Hypocoena Hamp.

2451 basistriga McD.
1. Kamloops.
2. August.

Amphipoea

2459 americana Speyer.
a pacifica Sm.
1. Kamloops.
2. July, August.

Achytonix McD.

near 2558 praeacuta Sm.
1. Kamloops.
2. August.

Platyperigea Sm.

2654 camina Sm.
1. Kamloops.
2. August.

Caradrina

near 2660 morpheus Hufn.
1. Kamloops.
2. June, July.

Laphygma Gn.

2683 exigua Hbn. *flavimaculata* Harv. Beet armyworm.
1. Vancouver Is., Ladner, Pavilion, Kamloops.
2. July, August, September, October. A migrant from the south.

Subfamily HELIOTHIINAE

Schinia Hbn.

2982 walsinghami Hy. Edw.
1. Kamloops.
2. August.

Subfamily PLUSIINAE

Chrysaspidia

3273 putnami Grt.
1. Kamloops.
2. August.

Subfamily CATOCALINAE

3346 unijuga Wlk. *lucilla* Worth.
1. Kamloops.
2. September.

3352 faustina Stkr.
1. Kamloops.
2. September, October.

Family GEOMETRIDAE
Subfamily GEOMETRINAE

Cheteoscelis Prout.

4079 bistriaria Pack. *udinaria* Stkr.
1. Summerland.
2. June.

Subfamily ENNOMINAE

Pero H.-S.

5072 honestarius Wlk. *stygiarius* Wlk. *dyari* C. & S.
1 Kamloops.
2. May.

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The author is indebted to Dr. D. F. Hardwick, Entomology Research Institute, Canada Department of Agriculture, Ottawa, for identification of specimens and encouragement in publishing the appended list.

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AN INCIDENT OF DESTRUCTION OF HONEYBEE COLONIES IN THE INTERIOR OF B.C. BY AN ANT, PROBABLY FORMICA INTEGRA NYLANDER

In a letter received on June 3, 1959, from Mr. J. C. Keswick of Osoyoos, B.C., he advises that a few of his honeybee colonies were moved from Osoyoos up into the Anarchist Mountain area as a safeguard against destruction by Sevin. Four days after moving, Mr. Keswick checked his colonies at which time a great deal of ant activity was noticed. Upon checking the first colony in line it was found to be empty; the only trace of bees being a little capped brood and about a quarter of an inch of wings on the bottom board of the hive. The second hive examined was found to be in the same condition and the third one was just being invaded.

According to Mr. Keswick it was an amazing thing to observe the ants attacking honeybees. Generally at least three ants would attack a bee, snip her in two at the join of the abdomen and thorax, snip off the wings and head, and carry the dissected bee to their nest.

It would appear that as soon as the honeybee colony had been destroyed the ants then polished off any stores of honey, pollen or brood. The hive next in line had not been touched, neither were the remainder of the colonies.

Mr. Keswick carefully checked the area and at about forty feet from the colony a large nest of ants was discovered. This was destroyed after dark and specimens of the ants were sent to the author who in turn had them mailed to G. L. Ayre of Research Branch, Summerland, where they were identified as probably being *Formica integra* Nylander. This species is common in the Okanagan and because of its predacious habits is generally considered to be beneficial. It is very indiscriminate in its choice of food and will take anything handy.

—*J. Corner, Provincial Apiarist, Vernon, B.C.*

AN EXPERIMENT IN CONTROLLING DDT-RESISTANT CODLING MOTH, CARPOCAPSA POMONELLA L.[1]

J. MARSHALL AND K. WILLIAMS[2]

The presence in British Columbia of a race of the codling moth, *Carpocapsa pomonella* L., resistant to DDT was demonstrated in a laboratory experiment in 1958 by Marshall (1). The same year, in an attempt to save the crop in the orchard that was most heavily attacked by the DDT-resistant insect, second brood spraying was carried out with a new insecticide that had given good results in 1957 against what had been considered a normal codling moth population. The new insecticide was the carbamate Sevin (N-methyl-1-naphthyl carbamate).[3]

The results of this late spraying were encouraging enough to justify a careful orchard assessment of Sevin in 1959. To broaden the experiment a second new insecticide, having a molecule structurally quite different from either DDT or Sevin, was also examined. It was the organo-phosphate Ethion (O, O, O′, O′-tetraethyl, S, S′-methylene bisphosphorodithioate)[4].

Experimental

An orchard in the Glenmore district near Kelowna was used for both the 1958 and 1959 experiments. In 1958 one acre was sprayed twice, and in 1959 seven acres were sprayed five times.

The trees were mature McIntosh and Delicious with a diameter of 20 to 30 feet, and an average height of about 18 feet. One series of seven plots was in a block of McIntosh trees, and a second series of seven plots, sprayed with the same materials and the same equipment, in a block partly of McIntosh and partly of Delicious trees.

The two experimental chemicals were applied to separate half-acre plots, each containing 20 to 30 trees, with three different orchard concentrate sprayers. Of these a 1955 model Turbo-Mist[5] and a 1959 model Swanson[6] were independently powered with gasoline engines. The third machine was a compact, experimental power-take-off unit designed and built at the Summerland Research Station. Designated Okanagan Experimental Sprayer Mark II, it is the subject of a separate article by McMechan and Williams (2). DDT was applied to only one plot (duplicated) with the Turbo-Mist machine.

In the course of the season three cover sprays were applied against the first brood codling moth, and two against the second brood. The first application was made a week after petal-fall.

DDT and Sevin were used as 50 per cent wettable powders, and Ethion as a 25 per cent wettable powder. The dosage in all plots was 50 imperial gallons of spray concentrate per acre.

Fruits were analyzed for spray deposits immediately following the last cover spray, and again, at harvest 34 days later. Ten apples were sampled from each of six trees per plot.

At harvest the numbers of worm-infested and "stung" fruits were noted in 500 fruits sampled from each of five 25-bushel bins from the centre trees of each plot.

[1] Contribution No. 46 from the Regional Research Station, Canada Department of Agriculture, Summerland, British Columbia.
[2] Entomologist and Chemist respectively.
[3] Union Carbide Corp., White Plains, New York, U.S.A.
[4] Niagara Chemical Div. Food Machinery Corp., Middleport, New York, U.S.A.
[5] Okanagan Turbo-Sprayers Ltd., Penticton, British Columbia.
[6] Swanson Sprayers, Okanagan Centre, British Columbia.

Results

Bearing in mind the percentage of active ingredient in each of the three insecticides, and the quantities applied per acre, the chemical determinations listed in Table 1 show that the three different sprayers applied roughly similar amounts of insecticides to the tops, and to the bottoms, of the trees. In each case about one-fourth as much insecticide was deposited on the fruits in the tops of the trees 12 to 15 feet above ground as on the fruits in the bottoms of the trees.

TABLE I—Average Spray Deposits from Duplicate Plots Following Last Cover Spray

Plot	Machine	Material	Amount per acre, lb.	Parts per million	
				Top of tree	Bottom of tree
1	Turbo-mist	DDT 50%	12	1.9	9.2
2	Turbo-mist	Sevin 50%	6	1.0	4.1
3	Expt. Mark II	Sevin 50%	6	0.8	3.5
4	Swanson	Sevin 50%	6	1.3	4.0
5	Turbo-mist	Ethion 25%	12	1.4	5.1
6	Expt. Mark II	Ethion 25%	12	0.8	4.4
7	Swanson	Ethion 25%	12	1.3	4.3

Table 2 giving the spray deposits immediately following the last spray application, and the residue that was present 34 days later, suggests that Sevin is less persistent, and Ethion more persistent, than DDT. (In a short article there is only room to tabulate averages; but the averages do sum up what was suggested by the unabridged results.)

TABLE II—Average Spray Deposits, Bottoms of Trees, Immediately Following Last Spray Application and at Harvest, 34 Days Later

Plot	Machine	Material	Amount per acre, lb.	Parts per million	
				Last spray	Harvest
1	Turbo-mist	DDT 50%	12	9.2	3.3
4	Swanson	Sevin 50%	6	4.0	0.8
7	Swanson	Ethion 25%	12	4.3	2.2

The next table shows that many more fruits were injured by the codling moth in the plots sprayed with DDT than in the plots sprayed with the two experimental compounds. But the difference was, in fact, far greater than the figures suggest. That was because, first, the amount of active ingredient applied per acre was twice as great in the DDT plots as in the Sevin or Ethion plots. Second, as the outcome of codling moth infestation, at least half of the fruits had fallen from the DDT-treated trees before harvest; these were not assessed for codling moth injury. Virtually none of the dropped fruits in the other plots showed codling moth injury.

This experiment demonstrated in the field what had been suggested in the laboratory, and what had been the experience of the owner of the property; in this orchard the codling moth can no longer be controlled with DDT.

TABLE III—Codling Moth Infestation in Harvested Fruit (5,000 Fruits Each Plot Including Duplicates)

Plot	Machine	Material	Amount per acre, lb.	Apple variety	Fruits % stung	Fruits % wormy
1	Turbo-mist	DDT 50%	12	McIntosh	3.2	14.1
1A				McIntosh	4.8	39.0
1A				Delicious	7.2	41.2
2	Turbo-mist	Sevin 50%	6	McIntosh	1.8	0.6
2A				McIntosh	3.4	2.0
2A				Delicious	1.6	2.3
3	Expt. Mark II	Sevin 50%	6	McIntosh	2.1	0.4
3A				McIntosh	2.5	0.4
3A				Delicious	1.2	0.5
4	Swanson	Sevin 50%	6	McIntosh	1.8	0.9
4A				McIntosh	1.0	0.1
4A				Delicious	1.3	0.5
5	Turbo-Mist	Ethion 25%	12	McIntosh	3.3	2.2
5A				McIntosh	0.6	0.1
5A				Delicious	1.7	0.9
6	Expt. Mark II	Ethion 25%	12	McIntosh	7.4	4.3
6A				McIntosh	2.0	0.6
6A				Delicious	1.7	1.1
7	Swanson	Ethion 25%	12	McIntosh	6.6	3.8
7A				McIntosh	1.7	0.3
7A				Delicious	2.0	1.3

What then of the experimental chemicals? Of the two, Sevin, as applied with the Turbo-mist sprayer in plot 2, undoubtedly was subjected to heavier codling moth attack than Ethion because, in both of the experimental blocks, plot 2 immediately adjoined the DDT plot. So plot 2, doubtless, was heavily invaded by second generation moths that had developed due to the failure of DDT. That is probably the explanation for the slightly heavier infestation in plot 2 than in the other plots, (3 and 4), that were sprayed with Sevin. The over-all performance of Sevin, in this orchard experiment, shows that this material was evidently about as effective against DDT-resistant codling moths as was DDT against non-resistant codling moths when the later insecticide was introduced into British Columbia 15 years ago.

To judge from the records of infestation alone, Ethion, although apparently less effective against DDT-resistant codling moth than Sevin, is nevertheless a promising material. There is, however, another consideration; about a month before harvest some defoliation occurred on Delicious trees that had been sprayed with Ethion. On the other hand, Sevin gave no evidence of phytotoxicity in this orchard, but experience elsewhere indicates that Sevin may have a thinning effect if applied to fruitlets shortly after petal fall.

The experimental effects of Sevin and Ethion on orchard pests other than the codling moth may be summarized in a few words. Five applications of Sevin gave adequate control of the green aphid, *Aphis pomi* DeG., but resulted in a heavy infestation of the mite, *Tetranychus mcdanieli* McG. Ethion, on the other hand, gave good control of the mite, but not of the aphid.

Summary

1. Against a codling moth population highly resistant to DDT, the carbamate Sevin and the organo-phosphate Ethion gave good control.

2. Sevin gave adequate control of the green aphid, *Aphis pomi* DeG., but resulted in a heavy infestation of the mite, *Tetranychus mcdanieli* McG. Ethion had the opposite effect.

3. On apples, Sevin left a less persistent deposit than DDT, and Ethion a more persistent deposit.
4. Ethion caused some defoliation of Delicious apple trees a month before harvest. Sevin caused no phytotoxic effects either on McIntosh or on Delicious.

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A BREEDING PLACE OF XESTOBIUM ABIETIS FISHER
(Coleoptera: Anobiidae)

In his check-list of the Coleoptera of North America, Charles Leng records only 2 species of the anobiid genus *Xestobium, X. rufovillosum* (DeG.) the notorious deathwatch beetle of Europe which Leng records from New England, Illinois and Indiana, and *X. affine* Lec. from Vancouver and California.

In mid-February, 1960, Professor K. Graham gave me 2 chunks of very punky wood taken from a rotten top branch of a broad-leafed maple *Acer macrophyllum* Pursh. at Langley Prairie in the lower Fraser Valley and a couple of beetle grubs which he had dug out of the wood. I dug out another grub and put the wood into a plastic bag. In a few days time 2 beetles emerged which keyed out to genus *Xestobium* but were definitely not *rufovillosum* of which I have several specimens sent to me for reference from the government laboratory at Princes Risborough, England. My specimens have exactly the same type of markings consisting of scattered patches of pale golden-yellow recumbent hairs on a black background, but are only 4/5 the length and 1/3 the breadth, of *rufovillosum*.

I sent the specimens to Mr. Gordon Stace Smith of Creston who replied: "I have spent a lot of time with your *Xestobium;* it was your host record that puzzled me. I collected a type series of 4 specimens, extracting them from pupal cells in a dry tree of *Abies grandis* Lindl, the white fir. No other specimen is known until yours so it must be regarded as very rare. Fisher who described the species retained 2 and I have 2 paratypes".

The wood from which my beetles emerged and (August, 1960) are still emerging is so rotten that one can easily stick a finger into it; it is white with the dry rot fungus *Poria* which Dr. R. J. Bandoni of the Department of Botany at the University tells me is either *Poria ferrea* or *P. ferruginosa* both of which cause white rot. Emergence records of the 10 specimens that I retained are Feb. 26, 2; March 1, 2; March 5, 2; March 26, 3; August 4, 1.

I kept some of the beetles alive in a glass jar for 2 weeks where they did not seem to feed on anything, not even on the brown mycelium of the *Poria* but they periodically drank water sprayed into the jar. Some mated and went through the motions of laying eggs in bits of fungus-covered wood so I hope to raise another generation. On bright days they were very active but on dull overcast days they were quiescent, hiding under trash.

Note

On 26 August I received this note from Mr. W. J. Brown, coleopterist of the Science Service *"Xestobium abietis* Fisher. The habitat seems wrong but I can make it nothing else. Our specimens are from long-dead standing fir."

—*G. J. Spencer, University of British Columbia, Vancouver.*

ON THE NESTS AND POPULATIONS OF SOME VESPID WASPS

G. J. SPENCER[1]

The year 1957 was a year of wasp abundance in the lower Fraser Valley as was 1943 in the interior of the Province.

I had occasion to remove a number of nests of *Vespula* (*Dolichovespula*) *arenaria* (Fabricius) and one each of *V. vulgaris* (L) and *V. pensylvanica* (Saus.) in West Point Grey district of Vancouver and kept counts of the populations in each nest. The procedure in taking the nests was to wait until at least 10:30 at night when all activity had ceased around the nests and to set up a powerful spotlight at a distance on a stand so as to illuminate the area, then to squirt the jet of a 5% D.D.T. aerosol bomb into the entrance of the nest while holding underneath a sack stretched open on a round frame of heavy wire. The wasps poured out into the sack; when no more came out the nest was cut from its supports, dropped into the sack and examined next morning when practically all wasps were dead. Later, I used a small compression sprayer filled, at the suggestion of Professor K. Graham, with carbon tetrachloride which was much faster than the D.D.T. aerosol bomb since it immobilized the wasps instantly; however those that had not received a good shot of it tended to recover and had to be re-treated. Since all the nests contained combs with capped pupal cells, they were caged until emergence had ceased, then counts were made of each caste and the nests were set aside for the emergence of parasites and scavenger moths, which may occur as much as 10 months later.

TABLE of Populations of Wasps Nests

Nest No.	Drones	Queens	Workers	Total	Parasites	Caterpillars
D. arenaria						
1	470	77	695	1242	150	1
2	132	160	612	904	0	2
3	1	42	241	284	3	0
4	159	6	146	311	12	0
5	0	1	53	54	3	0
V. vulgaris						
6	32	43	2230	2305	0	0
V. pensylvanica						
7	126	33	224	383	0	0

Notes on These Nests

The parasites mentioned in the table are *Sphecophaga burra* (Cresson), Ichneumonidae (3) and the caterpillars are those of the moth *Vitula serratilineela* Ragenot, Pyralidae, as determined by comparing their adults with those in the Blackmore-Wynne collection at the University; this identity has not been checked by an authority.

Nest 1 taken 28 June 1957 from under the eaves on the south east corner of a garage, consisted of 6 combs inside 4 outer paper walls. The number of drones in this nest is surprising, being nearly 38% of the total population and 6 times the number of queens.

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Nest 2 taken 5 July from under the steps on the south east corner of a back verandah, consisted of 7 combs and 4 outer paper walls. Samples of these wasps were weighed directly after being killed to give the relative weights of each caste; 99 drones weighed 17 grams = 0.1717 grams each; 135 queens weighed 40.4 grams = 0.2886 grams each and 612 workers weighed 70.8 grams = 0.1157 grams each.

Nest 3 taken 24 July was scraped off a window pane facing south in a cottage on the first slope of Mount Seymour; it consisted of 4 combs and a new and completely empty one the size of a silver dollar, under no fewer than 11 outer walls reducing to 6 at the entrance and was obviously a new nest. Of the 42 queens, 13 were race *fernaldi* and of the 241 workers, 3 were *fernaldi*. The race *fernaldi* (Lewis) according to Bequaert (1), is only a xanthic form of *arenaria* characterized by 2 large round yellow spots on the propodeum which are not found in normal *arenaria*.

Nest 4 was brought in by a sanitary inspector on July 29 and consisted of 7 large combs; he had removed it from a laurel hedge after drenching it with gallons of insecticide, thus reducing it to a soggy mess. From the size of the combs, this must have been a very large nest with a large population of wasps of which only a few (311) reached me. Since drones usually hang around a nest, their number, 159, was probably normal but most of the workers were missing. Of the drones, 42 were race *fernaldi;* of the 6 queens, 4 were *fernaldi* and of the 146 workers, 46 were *fernaldi*. According to Buckell and Spencer (3) drones are not usually of the race *fernaldi* so this number 42, is of note. No nests have yet been taken where all wasps were of race *fernaldi*.

Nest 5, given me by Dr. K. Graham, was taken by him on 6 August at Langley Prairie and consisted of only 2 combs of which the larger was 2¾ x 2½ ins. across. The nest had obviously been recently started because the queen only was of normal size, the 53 workers were very small.

Nest 6, Vespula vulgaris (Linn.) was taken 23 August from under the roots of a clump of iris in a rock garden facing north. The entrance was about one inch across and the combs when excavated from between the plant roots and stones were found to be of very irregular shapes and sizes and to occupy a hole roughly 12 ins. x 10 ins. There were no outer walls. The labour involved in excavating such a large hole must have been colossal. One queen out of the 43 taken was immense and was probably the founder of the nest; the others were apparently the season's brood. Amongst the normal - sized workers were over 80 only one third the size of the others, being about 1 centimetre long; Mr. C. D. F. Miller, hymenopterist of the Research Branch, Ottawa, informs me that such dwarfs sometimes occur in wasps' nests and are apparently only xanthic forms of normal specimens; the reason for their occurrence is unknown.

Nest 7. On 19 October 1958 I was asked to remove a wasps nest from a compost heap in a friend's garden. The heap consisted of regularly-cut slabs of turf built up like bricks in a wall with spaces between the sods. Taking this apart sod by sod, I found a number of little combs lying between the slabs with a dozen or so wasps around each comb, none of which contained brood or even eggs: each group had to be poisoned separately and the wasps collected. Well down inside the pile was the main comb with a large number of *Vespula*

pensylvanica (H. de Saussure) wasps around it. As with Nest 6 of *V. vulgaris* in the ground, there were no parasitized cells or scavenger caterpillars in the combs: apparently subterranean nests escape these intruders. It seems strange that workers should make isolated groups of cells away from the main colony; apparently the urge of the workers to build cells was stronger than that of the queens to lay eggs in them.

On 17 January 1958 a citizen in the Dunbar district of Vancouver telephoned to say that he had a wasp's nest in the corner of a back verandah roof, that measured 3 feet across: in spite of my doubting it, he stuck to his story. So I went over and after an arduous journey through my lady's dresses in a clothes closet, up a ladder and through a small trap-door in the roof, across the whole house length of rafters travelled the last part of the way on my stomach, I reached the corner where the sloping roof of the house met that of the verandah. Across the right angle of the corner was a nest 3 feet across and 18 ins. high, even as the owner had stated. From what I could reach of the nest I scooped out a few handsful of comb and later recovered from it 2 dead workers and one male of *Vespula pensylvanica* (H. de Saussure), one *Ptinus fur* Linn. the white-marked spider beetle, one *Ptinus ocellus* Brown (*tectus* Boield) the Australian spider beetle, several exuviae of *Anthrenus verbasci* (Linn.) the varied carpet beetle and one scavenger moth caterpillar. The owner said that the nest had been inhabited for 2 years in succession and feared that it would be re-occupied the coming season. I urged its total removal and the blocking-up of the entrance holes since the dermestid beetles that it haboured could very well invade the house.

Further note on the scavenger moth Vitula serratilineela Rag.

In August, 1959, I was given two nests of *D. arenaria* and one of the white faced hornet *Vespula maculata* (Linn.) with a few dead wasps in each and evidences of caterpillar silk between the tiers of comb of *arenaria* but not of *maculata*. They were maintained in a carton with a loose cover and from the end of February, 1960, to the end of June, moths flew out of the carton and around the room where the better specimens were collected and pinned. By August every comb was plastered with silk webbing and the frass of caterpillars, and the frass of wasp larvae which is compacted at the base of every cell, was completely consumed; dried bodies of wasp larvae and pupae, were not eaten. This would indicate that the larvae of this moth are true scavengers and not predators of early stages of wasps. Further proof of the scavenging behaviour of these larvae was obtained when fifteen moths picked up dead from the window sill were placed in a covered Syracuse watch glass for relaxing later on. Some weeks afterwards when I examined the dish, I found that the bodies of all the moths had been eaten and a full-grown caterpillar was moving amongst the loose wings; this pupated and a moth eventually emerged. Apparently a moth had laid an egg on the body of one of those lying dead on the window sill and the resulting caterpillar found enough food in 15 moth bodies, to complete its development.

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A WHOLE-BARK METHOD OF REARING DRYOCOETES CONFUSUS SW.

A. C. MOLNAR[2] AND C. B. COTTRELL[3]

Introduction

During studies on the relation of a fungus, *Ceratocystis* sp., to the western balsam bark beetle, *Dryocoetes confusus* Sw., it was found necessary to rear the insect in the laboratory. Lacking proven methods, a search was made among those used for other cambium-feeding insects, to find one which would be suitable for *Dryocoetes* or which would at least serve as a starting point for developing a satisfactory method. With a few modifications, a whole-bark rearing method used by Finnegan (1) to rear the pine weevil, *Pissodes approximatus* Hopk., was found very satisfactory. All stages of *Dryocoetes confusus*, from egg to adult developed well in alpine fir, *Abies lasiocarpa* (Hook.) Nutt., whole bark and were readily observed during their development.

Method

Finnegan placed newly hatched larvae in small grooves in the cambial surface of freshly cut Scots pine, *Pinus sylvestris* L. bark discs. The discs were then pressed tightly, cambial surface down, in the bottom of petri dishes by filling them with moist sand and applying pressure on the cover with rubber bands. He indicated the importance of using sterilized glassware and sand and keeping to a minimum the exposure of the cambial surface of the inner bark to the air during preparation.

Finnegan's method as used for *Pissodes approximatus* was moderately satisfactory for *Dryocoetes confusus* but a number of changes effected a marked improvement, particularly where the insects were reared throughout their life stages in a single rearing chamber. The changes made were largely in connection with improving the maintenance of suitable moisture conditions and with getting rid of the objectionable feature of sand sifting out of the chambers during handling. The sand was replaced by vermiculite, for vermiculite dried less quickly and more evenly. It also had a slight tendency to sift out but this was overcome by placing two slightly oversized pieces of filter paper in the chamber, one next to the bark and one next to the lid, to enclose the vermiculite. The filter paper provided the additional advantage of assuring an even distribution of water, which was added after about five weeks in long term observation chambers.

The procedures used for the preparation of materials and setting up rearing chambers for *D. confusus* were as follows:

1. Preparation of bark discs

Discs were generally cut from fresh alpine fir logs with non-corky bark, but equally satisfactory results were obtained using logs several weeks old when the ends were sealed with wax at the time of cutting and the logs were kept in a cool place. Immediately before cutting the discs the logs were scrubbed with 70 per cent methyl alcohol and the thin outer bark was sliced off with a clasp knife or draw knife. Discs of the right size to fit the 100 mm. dishes used were readily obtained by cutting around a template with a sharp-pointed, sturdy knife and slicing through between the inner bark and cambium. To maintain the bark as aseptic as possible until being used in the rearing chambers, the discs were stacked in sterilized, metal petri dish holders alternately

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with fresh filter paper. It was found desirable to use the bark within a few hours after cutting, although overnight storage in a refrigerator did not appear to be detrimental. Complete asepsis is not possible, of course, for even if the bark were rendered aseptic, beetles or larve gathered in the field would introduce their naturally associated flora and fauna. These were in fact found to develop in the rearing chambers but very rarely inhibited the development of the insects.

2. The moistening medium

The moistening medium was prepared in advance by dry-sterilizing fine-grained vermiculite at 95° C for 48 hours. To this was added sterile water at the rate of one volume of water to four volumes of vermiculite. Two gms. of sodium benzoate were added to 1,000 mls. of the sterile water to inhibit bacterial activity.

3. Setting up rearing chambers

The procedure for setting up the rearing chambers was essentially that used by Finnegan except that some of the materials were different as indicated. A number of features were particularly critical to the success of the rearings and should be emphasized:

a) The nature and size of the bark niches in which the insects were started was important for eggs and larvae. A size just large enough to hold the larvae, preferable triangular in shape, appeared to be the best. A small triangular niche cut with a scalpel provided the necessary purchase for the larva to start feeding. Adults were less critical in this regard and a round hole to simulate a nuptial chamber, cut with a cork borer, served well.

b) After placing the insects in the niches care was necessary to make sure the inner bark was tightly pressed against the bottom of the dish by inverting the dish over it and holding it firmly until the first filter paper, vermiculite, second filter paper, lid, and rubber band were added. Space between the bottom of the dish and bark permitted insects to escape into these spaces where they were often unable to start feeding again.

c) It was necessary to avoid adding water to the extent that free moisture formed in the bottom of the dish, which tended to hold the insect immobile and often drowned it.

d) The rearing chambers were kept in a dark cupboard at room temperature.

Efficacy of Method

The primary purpose of the rearings of *Dryocoetes confusus* was to produce adults free from contamination by the apparently pathogenic fungus under study. Since the egg stage was the only one amenable to sterilization, it was necessary to rear the insect throughout its life stages. The results of rearings, however, suggested the suitability of the method for rearing studies beyond the scope of the present investigation. It appears suitable to life history studies and other laboratory investigations involving detailed observations on active living insects of this and probably other bark and cambial feeding species. Some of the results of rearings, especially survival figures, are summarized below to permit the reader to evaluate the method in terms of his own requirements.

Survival

Field collections of *Dryocoetes* for rearing purposes were confined to larvae and adults but transfers to fresh rearing chambers were carried out at the egg and pupal stages as well. The survival figures for rearings and transfers are summarized in Table 1. The relatively poor survival obtained with field-collected larvae

TABLE 1—Survivors from Rearing Studies of **Dryocoetes confusus** Sw. in Whole Bark-Petrie-Dish Rearing Chambers.

Time from start (weeks)	A Field larva (Oct. 1958 collection)	B Transferred larvae off-spring of "A"	C Transferred pupae off-spring of "A"	D Field adults (May 1959 collection)
		Number living		
0	289	71	21	55
2	129	57	—	44
4	119	55	16	44
8	102	—	—	—
16	73	—	—	—
Final disposition	Transferred for rearing studies	All survivors adults; discarded	All survivors adults; discarded	Rearing study; eggs transferred as needed, rest discarded

was not considered a reflection on the rearing method, for the larvae were sent by mail from Vernon to Victoria and nearly a week elapsed before they were placed in rearing chambers. In addition, they were first started with sand as the moistening medium, then changed to vermiculite when it was found that the sand would prove troublesome. It can be seen that 55 per cent of the mortality occurred in the first two weeks of rearings. In the other columns of this table it can be seen that relatively little difficulty was experienced in transferring laboratory-reared larvae and pupae and field-collected adults.

All eggs used in the egg-transfer studies came from breeding experiments using the wholebark rearing chambers described. Transfers to fresh rearing chambers were carried out using two methods of egg sterilization.

In the first method of egg sterilization, eggs were freed from boring dust and washed for 30 seconds with a 1:1000 solution of Hg Cl, followed by a sterile water wash for 60 seconds. The eggs were then placed in the described niches in fresh bark. In the second method eggs were washed with 95 per cent ethonal with a brush on sterile agar plates and moved to a clean part of the agar. A day later the eggs were transferred to bark niches with a sterilized needle.

There did not appear to be a significant difference in survival between the various methods and control used except for the poor results obtained in the second Hg Cl treatment (Table 2), but the writers favoured the

TABLE 2—Survivors of **Dryocoetes confusus** Egg Transfers

Time from transfer (weeks)	Eggs from adults reared from larvae (Table 1 "A")		Eggs from field adults mated in whole bark chambers		Eggs from field adults mated in whole bark chambers	
	sterilized Hg Cl	not sterilized	sterilized Hg Cl	not sterilized	sterilized ethanol	sterilized ethanol, inoculated with **Ceratocystis**
			Number living			
0	6*	15*	15*	15*	15*	25*
1	4	13	3	11	10	17
2	3	13	1	10	10	17
3	3	13	1	10	10	17
4	—	—	—	—	10	17
5	—	—	—	—	9	15
Final disposition	Broken up for isolation experiments. Larva only.		Broken up for isolation experiments. Larva only.		Broken up for isolation experiments; 3 adults remainder larvae	

* Healthy appearing eggs but some may not have been viable.

ethonal method because it involved less handling of the eggs and afforded less opportunity for over-exposure of the eggs to the sterilizing agent. It should be pointed out that the chambers with sterilized eggs did not remain entirely free from micro-organisms but they were free from the pathogenic *Ceratocystis* under study. To obtain aseptic chambers a suitable method of sterilizing bark will have to be developed which does not change its essential properties. Steam sterilization, a method recommended by Holst (2), rendered alpine fir bark somewhat plastic and unacceptable to both larvae and adults of *Dryocoetes*.

Development of *Dryocoetes confusus* in rearing chambers

Detailed observations and measurements on the insect's development were not included in the scope of these experiments and, since relatively little is known of its development in nature, little can be said concerning the effects of artificial rearing on development. A number of observations, however may be worth recording here.

1) The life cycle of *D. confusus* was carried to completion and viable eggs were produced by females reared in the chambers.
2) It was evident that the life cycle can be greatly accelerated through artificial rearings by reducing the normal periods of inactivity induced by unfavourable weather conditions. The progeny of the first set of larvae collected in the fall of 1958 attained maturity by the following May, a full year before this would have occurred under field conditions.
3) Survivors of larvae collected in the field in October attained adulthood at nearly a 1:1 male-female ratio, while 250 adults collected the following spring in the same area at Bolean Lake were in the ratio of 1:12 males to females.
4) Adults reared from larvae in the chambers started oviposition 6-7 days after mating on fresh bark, while field-collected adults started oviposition within 3 days of being placed on fresh bark in the chambers. The field collections were made as much as 2 months before normal oviposition when the insects were still frozen in the host trees. Thus, a much wider time scope is available for laboratory work with eggs than would be possible with those collected in the field; in addition field-collected eggs pose difficult handling problems and require time-consuming observations to collect the right stage.
5) Apparently mating in the spring is not required for females collected in the field. Females collected from frozen trees in the spring and placed unmated in rearing chambers produced viable eggs in abundance.

Conclusion

Finnegan's method for rearing weevils in whole-bark rearing chambers, with minor modifications, met the requirements for the laboratory rearing of *Dryocoetes confusus*. The results of experiments indicate the suitability of the method for detailed observations on all phases of the insect's development from egg to adult. The adaptability of the method to other bark and cambial feeding insects is suggested by its success with two widely separated species.

The advantages of the method are the simplicity of the set-up and procedures, readily available materials, the lack of a troublesome moisture problem, and the ease of observing development at any time (Figs. 1, 2, and 3). While 100 mm. petri dishes were used in these studies, larger sizes are available if desired.

The possibilities of adapting this rearing method to standard insectary procedure for rearing larvae of unknown bark and cambial feeding insects sent in through the Forest Biology Survey are worth investigating. Materials and procedures could be readily set up. The main problem would stem from the unavailability of bark of the right species; but this difficulty could be overcome by one or both of two ways. Logs with waxed ends could be kept in cool storage for considerable periods without the bark losing its desirable qualities, or the collector could air-mail a section of wood and bark with his collection of unknown larvae.

Acknowledgements

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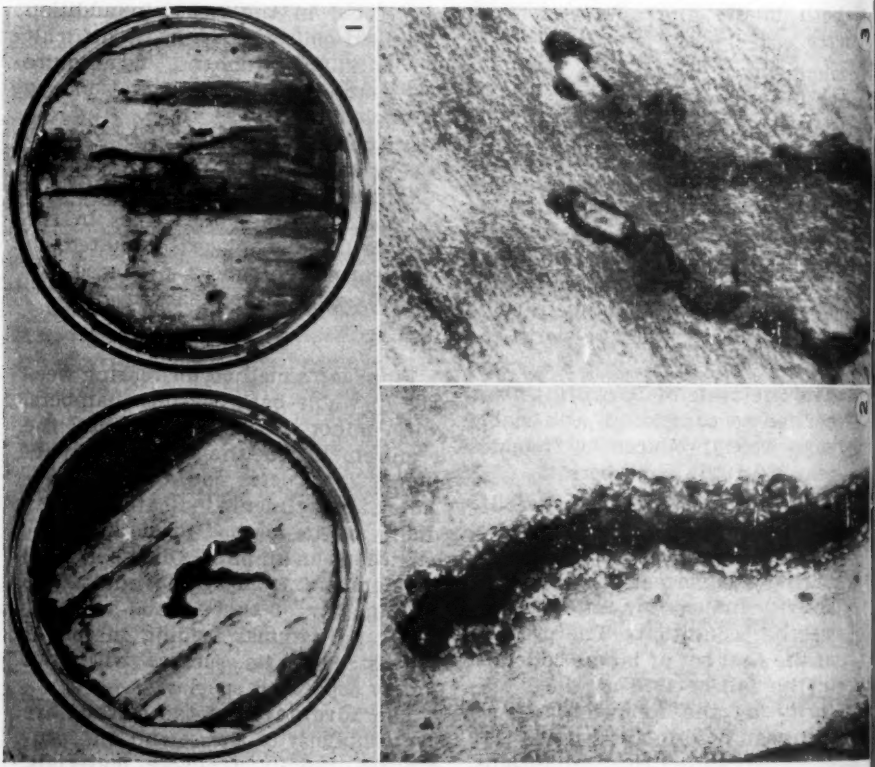

Fig. 1.—Underside of whole-bark rearing chambers showing **Dryocoetes confusus** feeding galleries on the left and egg galleries on the right. 0.6 X.

Fig. 2.—Egg gallery in whole-bark rearing chamber showing deposited eggs and female **Dryocoetes** in process of extending gallery. Approximately 8 X.

Fig. 3.—Newly hatched larvae of **D. confusus** in whole-bark rearing chamber. Approximately 8 X.

OBSERVATIONS IN THE INTERIOR OF BRITISH COLUMBIA DURING 1959 OF THE EFFECT ON HONEYBEES OF ORCHARD SPRAYING WITH SEVIN

J. C. ARRAND[1] AND J. CORNER[2]

In 1959 in the Interior of British Columbia a new insecticide, Sevin, 1-naphthyl *N*-methylcarbamate, was recommended for the control of several orchard pests. During the early part of the season reports were received from throughout the Okanagan and Kootenay Valley that where Sevin was used honeybees were being killed. Observations by the authors, particularly in the Oyama and Salmon Arm districts, substantiated these reports and confirmed the work of Anderson and Atkins (1959) that Sevin is highly toxic to honeybees. Sevin applied as a pink spray killed a considerable number of foraging honeybees from colonies located within about one mile of the treated orchards. The mortality of bees, as observed at the hive entrances, was extremely heavy for about three days after spraying. Dead bees continued to appear, although in greatly reduced numbers, for a further three to four days. There was no evidence of brood poisoning although, due to a depletion in the numbers of workers, there was some larval mortality from chilling.

In many cases the wet weather during the spring of 1959 caused a delay in applying the "pink spray" until the late pink or early bloom stage. Lime sulphur which has been reported (Eckert, 1949) to have some repellent action and is usually applied in the pink spray was not applied with Sevin because the two materials are not compatible. These factors may have contributed to the high honeybee mortality. It is interesting to note that according to Carl Johansen (1960) a new bee repellent, R 874 (hydroxyethyl octyl sulfide), shows promise and may be effective in safeguarding bees against hazardous insecticides.

There appeared to be little ill effect on honeybees where Sevin was used as a cover spray for codling moth control.

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DICTYONOTA FULIGINOSA COSTA (HEMIPTERA: TINGIDAE) IN THE NEARCTIC

G. G. E. SCUDDER[1]

During 1959 samples of populations of Mirid Heteroptera on broom (*Sarothamnus scoparius*) were taken on the campus at the University of British Columbia. In July and August specimens of a Tingid, *Dictyonota fuliginosa* Costa, were also beaten from this plant; determination of the Tingid has been verified by Prof. C. J. Drake of the United States National Museum. This capture appears to be the first record of this insect in the Americas, although the related *D. tricornis* (Schrank) occurs in eastern Canada and the eastern United States. *D. fuliginosus* is a common insect on broom in Europe and since this plant has been introduced into British Columbia, it seems probable that this insect has also been introduced. Broom was abundant at Beacon Hill, Victoria in 1911 (J. Davidson via G. J. Spencer, *pers. comm.*), and was probably introduced by the early English settlers between 1890 and 1900. Broom is now widely scattered in the lower Fraser Valley and on Vancouver Island; it also occurs in the lower Interior of the Province, but in the latter seems to bear little insect life.

The broom Mirid collected in this study was the introduced *Melanotrichus virescens* (D. & S.) and this was found to be very abundant, yet it has not previously been taken on the mainland. Downes (1957) records taking *M. virescens*[2] on Vancouver Island and I have seen specimens from Victoria, Nanaimo and Cowichan. Thus, although *D. fuliginosa* has not previously been recorded from the area in question, it is probably not a recent introduction.

In the Heteroptera in Canada and the United States, at least 90 species appear to be Holarctic, or at least, are recorded from the Palaearctic and the Nearctic regions. A number of these appear to have been introduced into one of the areas. Species almost certainly introduced into the Nearctic and occuring in British Columbia include: *Megalonotus chiragra* (F.), *Nabis major* Costa, *Heterotoma meriopterum* Scop., *Campyloneura virgula* Fieb., *Dicyphus pallidicornis* (Fieb.), and *Blepharidopterus angulatus* (Fall.). These introduced insects may have come in on plants, for example *Dicyphus pallidicornis* on foxglove (*Digitalis*) (Downes, 1957) or they may have come in by other means as in ballast, suggested for *Megalonotus chiragra* by Slater & Sweet (1958). However, these are the few exceptions and most of the other 'Holarctic' species need critical examination, since most if not all of the non-arctic species, with a wide distribution would appear to be endemic rather than introduced. A critical examination of a few of these has shown that the Old and New World representatives are not conspecific.

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[2] **M. virescens** (D. & S.)=**M. concolor** of Downes.

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CONTROL OF THREE SPECIES OF LEAFHOPPERS, ON RUBUS IN BRITISH COLUMBIA[1]

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Ribautiana tenerrima (H.-S.) and *Edwardsiana rosae* (L.), both of Typhlocybinae, and *Macropsis fuscula* (Zett.), of Macropsinae, frequently damage various species of *Rubus* on Vancouver Island and in the lower Fraser Valley.

Ribautiana tenerrima, and *E. rosae*, have similar life cycles and habits (Raine, 1960; Childs, 1918). There are two generations each year; nymphs emerge during May and again in August, and adults appear during June and September. Both species overwinter as eggs. Feeding by nymphs and adults on the undersides of the leaves causes a characteristic whitish stippling, impairs leaf function, and reduces plant vigour.

Macropsis fuscula, a European species, has only one generation each year. Nymphs emerge from overwintered eggs in late May, and adults appear during July (Tonks, 1960). In the Netherlands this species is reported as a vector of the virus disease known as rubus stunt (de Fluiter, 1953). The nymphs feed mostly on the undersides of the calyces of flower buds and fruit. Damage to the berries is not readily visible, but studies during 1959 showed a 20 per cent reduction in yield from heavily infested plots compared with clean plots. Fruit quality may be reduced by the growth of a sooty-mould fungus in honeydew excreted by the leafhoppers, and nymphs included with the fruit during picking become a contamination problem.

This paper presents results obtained with several materials for control of the three species of leafhoppers. The work was conducted on Vancouver Island, and in the lower Fraser Valley, from 1955 to 1959.

Materials and Methods

The following chemicals were used in the experiments:

DDT, 25 per cent liquid; Chipman Chemical Company, Toronto, Ont.

Derris, 2.5 per cent liquid and 1 per cent dust of rotenone; Chipman Chemical Company, Toronto, Ont.

Diazinon, 25 per cent liquid and 5 per cent dust of *O*, *O*-diethyl *O*-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate; Geigy Agricultural Chemicals, Yonkers, N.Y.

Dimethoate, 46 per cent liquid of *S*-methylcarbamoylmethyl *O*, *O*-dimethyl phosphorodithioate; American Cyanamid Company, Stamford, Conn.

Di-Syston, 5 per cent granules of *O*, *O*-Diethyl *S*-2-(ethylthio) ethyl phosphorodithioate; Chemagro Corporation, Kansas City, Mo.

Endrin, 18 per cent liquid of endrin; Velsicol Corporation, Chicago, Ill.

Ethion EC 4, liquid containing four pounds of *O*, *O*, *O'*, *O'*-tetraethyl *S* *S'*-methylene bisphosphorodithioate per U.S. gallon; Niagara Chemical Division, Food Machinery and Chemical Corporation, Middleport, N.Y.

Guthion, 18.4 per cent liquid of *O*, *O*-dimethyl *S*-4-oxo-1, 2, 3-benzotriazin-3 (4*H*)-ylmethyl phosphorodithioate; Chemagro Corporation, Kansas City, Mo.

Heptachlor, 25 per cent liquid of heptachlor; Velsicol Corporation, Chicago, Ill.

Malathion, 57 per cent liquid and 4 per cent dust of malathion, American Cyanamid Company, Stamford, Conn.

Methoxychlor, 25 per cent liquid of 1, 1, 1-trichloro-2, 2-bis (*p*-methoxyphenyl) ethane; Geigy Agricultural Chemicals, Yonkers, N.Y.

Phorate, 48.5 per cent liquid of *O*, *O*-diethyl *O* (and *S*)-2-(ethylthio) ethyl phosphorothioates; Chemagro Corporation, Kansas City, Mo.

Phosdrin, 48.5 per cent water-soluble liquid of 2-methoxycarbonyl-1-methyl vinyl dimethyl phosphate; Shell Oil Company of Canada, Toronto, Ont.

Rogor, 40 per cent liquid of S-methylcarbamoylmethyl *O*, *O*-dimethyl phosphorodithioate; Fisons Pest Control Limited, Cambridge, Eng.

Sevin, 50 per cent wettable powder and 13 per cent emulsion of 1-naphtyl *N*-methylcarbamate; Union Carbide Chemicals Company, New York, N.Y.

Systox, 26 per cent liquid of a mixture of *O*, *O*-diethyl *S*-(and *O*) (2-ethylthio) ethyl phosphorothioates; Chemagro Corporation, Kansas City. Mo.

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Thiodan, 24 per cent liquid of 6, 7, 8, 9, 10, 10-hexachloro-1, 5, 5a, 6, 9, 9a-hexahydro-6, 9-methano-2, 4, 3-benzodioxathiepin 3-oxide; Niagara Chemical Division, Food Machinery and Chemical Corporation, Middleport, N.Y.

Trithion, 43.7 per cent liquid of *O*, *O*-diethyl *S*-*p*-chlorophenylthiomethyl phosphorodithioate; Stauffer Chemical Company, Mountain View, Calif.

The experiments were conducted on loganberry because this crop was most heavily infested with the three species of leafhoppers.

Plots varied in size from year to year, but consisted of not less than four plants per plot, with three replicates. Buffer rows, or portable barriers, were used between plots to prevent spray drift.

Sprays and dusts were applied to the foliage in mid-May to control emerging nymphs. Sprays were applied to the canes in March to kill overwintering eggs. Systemics were applied as drenches to the crowns in April or painted on the canes in May to control emerging nymphs. Di-Syston granules were sprinkled on the soil around the base of the plants in April to control emerging nymphs.

The sprays were applied with a portable "Bean" sprayer operated at 100 lb. pressure. About 200 gal. per acre were required for foliage sprays, and 100 gal. when canes only were sprayed. The dusts were applied with a backpack puff duster at about 50 lb. per acre. The drenches were applied with the same "Bean" portable sprayer fitted with a 3-foot spray wand having a quick shut-off valve and a solid-cone nozzle. (Tee Jet TG3, John Brooks and Co., Ltd., Montreal, Que.). With the machine operating at 100 lb. pressure, one pint of drench was applied to each plant when the nozzle was held for 10 seconds about 15 in. above the crown. The DiSyston granules were used at one pound toxicant per acre.

Counts of Typhlocybinae nymphs were made in May, and late July, on the leaves of 10 to 25 fruiting spurs per plot, collected at random on one side of the row along the top wire. Populations of *M. fuscula* were assessed in late June or early July by counting the nymphs on 200 to 500 berries per plot from both sides of the row. Samples of loganberries treated with Rogor either as a drench, or as a foliage spray were frozen and shipped by air to Fisons Pest Control Ltd., England, for analysis of residues.

Results and Discussion

A summary of the materials used as foliar sprays and the results obtained appears in Table I. Survival is expressed as the mean number of *M. fuscula* nymphs per 100 berries, and the mean number of Typhlocybinae nymphs per 10 fruiting spurs. Where possible, data on the control of both generations of Typhlocybinae were evaluated, since reinfestation may occur from adjacent infested plantings.

Control of Typhlocybinae—One foliage spray of DDT, Thiodan, Trithion or Systox in mid-May controlled first-generation nymphs, and reduced reinfestation by the second generation in August. Diazinon, methoxychlor, Sevin, Guthion, Phosdrin, endrin, phorate, derris, Dimethoate, and Rogor controlled the first generation but did not prevent extensive reinfestation by the second generation. Heptachlor was ineffective.

The mean number of first generation Typhlocybinae nymphs per 10 fruiting spurs, following treatment with foliage dusts in mid-May were as follows:

Malathion	0
Diazinon	2
DDT	5
Derris	28
Check	180

DDT or Trithion spray applied to the canes in mid-March effectively controlled nymphs emerging in May. The action was probably residual rather than ovicidal.

TABLE 1—Mean number of nymphs of **Macropsis fuscula** per 100 berries, and of Typhlocybinae per 10 fruiting spurs, following treatment with foliage sprays in mid-May, 1955-59.

Insecticide	Pints per 100 gal.	Toxicant lb. per 100 gal.	Macropsis	Typhlocybinae 1st generation	Typhlocybinae 2nd generation
DDT	3	0.94	25	0	20
Derris (Cube)	4	—	6	6	—
Diazinon	2	0.63	0	0	59
Dimethoate	1	0.62	—	0	63
Endrin	1	0.25	—	0	183
Ethion	¾	0.46	0	—	—
Guthion	1	0.23	0	0	67
Heptachlor	2	0.62	—	203	192
Malathion	2	0.63	0	0	122
Methoxychlor	4	1.25	0	0	126
Phorate	¼	0.16	—	0	77
Phosdrin	½	0.13	—	0	72
Rogor	1	0.50	—	0	60
Sevin WP	2½	1.25	0	—	—
Sevin	8	1.25	—	0	52
Systox	¾	0.23	—	0	18
Thiodan	1	0.31	7	5	20
Trithion	½	0.31	0	0	19
Check	—	—	28	160	102

Results obtained with systemics showed that Dimethoate at one pint per 100 gal. applied as a drench to the crowns in early April controlled first generation nymphs, but did not prevent reinfestation by the second generation. Similar applications of Rogor at one-half pint, and Systox at one pint, per 100 gal., were not effective. Dimethoate at a dilution of 1:10 painted in a one-inch band on the canes of potted plants gave excellent control of nymphs within five days, and at dilutions of 1:100 and 1:800 significantly reduced infestations within 12 days. Granular Di-Syston was ineffective as a soil treatment.

Control of Macropsis fuscula — In the Netherlands, good control of *M. fuscula* is obtained with dormant sprays of tar oil or DNC to kill the eggs in the canes, or by spring applications of Parathion, malathion, Diazinon, or Systox to kill the nymphs (de Fluiter, 1958).

In British Columbia, a dormant spray of tar oil applied to loganberry in mid-March reduced *M. fuscula* infestations in June by 95 per cent; lime sulphur plus dormant oil was about 75 per cent effective. Control with water-soluble dinitrocresol was unsatisfactory. Probably because of better coverage, dormant sprays were more effective when applied after the canes were up on wires than when the canes were trailing on the ground. Dormant sprays have not been generally recommended for leafhopper control in British Columbia, because most growers leave the loganberry canes on the ground throughout the dormant period, and because it is difficult to operate heavy equipment on the land during the winter.

Foliage sprays of malathion, Guthion, Ethion, or Sevin applied once, in mid-May, gave excellent control. Thiodan and derris reduced infestations considerably but were less effective than the other materials. Fall sprays of methoxychlor, malathion, Diazinon, or Trithion applied to assess their potential ovicidal action caused no reduction during the following spring.

Dimethoate at one pint per 100 gal. applied as a drench to the crowns in early April significantly reduced the number of nymphs emerging in late May. Rogor at one-half pint, and Systox at one pint, per 100 gal., were not effective. Granular Di-Syston was in-

effective as a soil treatment.

Phytotoxicity—Ferbam, at three lb. per 100 gal. added to emulsible concentrate sprays of malathion, Diazinon, Trithion, methoxychlor, Guthion, and wettable powder sprays of Sevin, caused no deleterious effects on loganberry, nor did Captan, at three lb., added to malathion and Diazinon. Endrin 18 per cent emulsible concentrate at one pint per 100 gal. caused some injury to loganberry foliage. In previous experiments on phytotoxicity of spray materials, DDT and methoxychlor emulsible concentrates at four pints per 100 gal. caused some yellow spotting on raspberry; malathion 50 per cent emulsible concentrate, at two pints, occasionally caused a slight leaf burn on raspberry, particularly on young growth.

Residues — Residues of Rogor in loganberries at harvest were below 0.1 ppm, which is the limit if sensitivity of the clorimetric method for determining phosphorus. Samples for analysis were taken from Rogor treatments applied either as foliage sprays in mid-May at one pint per 100 gal., or as soil drenches in April, at one pint per crown, at a dilution of one-half pint per 100 gal. Dietary toxicity studies conducted by Fisons, including daily oral ingestion trials with humans, have shown that up to 2 ppm of Rogor may be regarded as innocuous in most human foods.

Summary

The bramble leafhopper, *Ribautiana tenerrima* (H.-S.), the rose leafhopper, *Edwardsiana rosae* (L.), (both Typhlocybinae), and *Macropsis fuscula* (Zett.), frequently damage *Rubus* species in British Columbia. One application of Trithion in mid-May controlled all three species, including second-generation nymphs of Typhlocybinae. Malathion, Diazinon, Sevin, methoxychlor, and Guthion applied in mid-May controlled *M. fuscula*, and first - generation nymphs of Typhlocybinae, but did not reduce infestations of the second generation. DDT controlled both generations of Typhlocybinae, but was ineffective on *M. fuscula*. Phorate, endrin, Phosdrin, and Systox, in trials conducted on Typhlocybinae, controlled the first generation; Systox reduced infestations by the first and second generation. Dimethoate applied as a drench to the crowns in April controlled nymphs of both Typhlocybinae and *M. fuscula* and also gave control of Typhlocybinae nymphs when applied as a foliage spray in mid-May. Residues of Rogor at harvest were at a safe level below 0.1 ppm. No deleterious effects were observed from the addition of Ferbam or Captan to foliage sprays on loganberry.

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NOTES ON THE LIFE HISTORIES OF TWO BUTTERFLIES AND ONE MOTH FROM VANCOUVER ISLAND

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Colias occidentalis Scud.

A specimen taken at Royal Oak on June 4, 1958, laid about 50 ova by June 12. They were placed on the upper side of the leaves of *Lathyrus nuttallii* Wats. over which the butterfly was confined.

Ovum

Size 1.5 mm. by 0.5 mm., fusiform, truncate at the base at the point of attachment, shiny, with about 14 ribs, whitish at first, becoming rosy-red with an ivory-white tip. Hatched June 11.

Larva—1st Instar

Length 2 mm. Head black, dull with short, sparse, white-knobbed hairs. Body fuscous green, covered with glandular-tipped hairs, A.8 and A.9 bearing a few long, backwardly directed, white hairs. The chorion was partly, or entirely, consumed by the larva.

2nd Instar

June 17. Length 5 mm. Head grey-green, body green matching the leaves. Both head, and body, with a hoary look due to a covering of close-set, glandular-tipped hairs, each arising from a small, black tubercle.

3rd Instar

June 23. Length 7 mm. Appearance similar to second instar larva. From this date until April, 1959, the caterpillars remained quiescent in the fold of a shrivelled leaf.

4th Instar

April 18, 1959. Length 10 mm. The larva showed signs of life on April 3. Head pale green, thickly dotted with short, black, non-glandular hairs arising from black bases. Body dark, velvety green, closely dotted with white, black-centred spots, each bearing a short, white, non-glandular seta. Segments with six transverse wrinkles.

5th Instar

April 25. Length 18 mm. Appearance as before, but with white hairs thickly distributed on the sides of the body but not on the dorsum. Spiracular line thin but conspicuously white, the white ring round the black dots replaced with green.

April 29. Length 25 mm. Appearance as before, with a faint pink suffusion along the spiracular line, underside glaucous - green minutely black-dotted.

When disturbed the larvae raised the thoracic segments in a sphinx-like attitude. Just before pupation they were 30 mm. long. Pupated May 4. Thirty-six hours elapsed between the first attachment by the last segment to a silken mat, and pupation with the head up and a girdle round the thorax.

Pupa

Size 23 mm. by 6 mm. The head was produced into a projecting beak, and there was a decided hump on the dorsum of thorax. Smooth, emerald green at first, becoming darker and assuming a yellowish colour towards maturity. The beak was dark green above and yellow below. The wing-cases showed faint dark lines of the venation beneath. The three abdominal segments beyond the tip of the wing-cases each had two small black dots. Spiracular line distinctly yellowish.

Imago

Emerged May 21, 1959, after 17 days' pupation.

The continuation of aestivation without a break into hibernation, both covering nearly ten months, is noteworthy. It would be of interest to know if this is the rule throughout the insect's wide range.

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Coenonympha inornata insulana McD.

This butterfly has a long period of flight on Vancouver Island, from May to October, with a marked gap in July, suggesting the occurrence of two broods per season. With the idea of clearing up this point, the life history was investigated during 2 years. Ova were obtained from specimens taken at Royal Oak on May 26, 1958.

Ovum

Size 1 mm. by 0.9 mm. Barrel-shaped, having a slight hollow in the upper end, with a distinct boss or umbo in the centre of the depression. Smooth, shiny, faintly ribbed and cross-ribbed, white, lightly flecked and streaked with brown to form an irregular band round the middle of the egg.

Larva—1st Instar

June 7. Length 2 mm. Head pale dull flesh coloured. Body tapering from head and of the same colour, with darker dorsal and subdorsals, and two fleshy anal processes directed backwards in line with the body.

2nd Instar

June 18. Length 4 mm. Appearance as before, with the addition of numerous small, white, mushroom-like protruberances covering both head and body, and seven dark green lines on dorsum, one dorsal and three on each side of it.

3rd Instar

June 25. Length 8 mm. Appearance as before.

4th Instar

July 3. Length 15 mm. Appearance as before.

5th Instar

July 12. Length 20 mm. Head grass-green, thickly covered with white mushroom-like protruberances. Body grass-green, with the mushroom-like bodies giving a glaucous bloom. The dorsal line and the three lines on each side of it dark green, spiracular line yellow, highlighting the lateral fold, spiracles evident as very small black dots, anal processes tinged with pink.

The larva was well camouflaged. As it rested along the edge of a blade of grass the tapering body merged into the blade and the large head simulated a tear or break in the edge. Various grasses are the food of this species. The succulence of the grass evidently affects the rate of metamorphosis.

July 16. Length 22 mm. at maturity. The larva suspended itself by the cremaster from a grass stem, and pupated on July 21.

Pupa

Size 10 mm. by 3 mm. Rather short and broad, smooth, grass-green, with a fuscous line on the costal and hind margins of the wing-cases, and two short fuscous lines on the underside of the last abdominal segment, converging to form a V at the base of the cremaster.

By August 1 the wing-cases had turned a light brownish colour, while the green of the rest of the body assumed a dull, muddy look, an indication that the imago was about to emerge. It died before doing so. Some larvae of the same age group grew very slowly. One of these was only 10 mm. long on October 9 and showed signs of hibernating for the winter.

In 1959 three imagos of a second brood were obtained; two were from ova laid on June 13. They emerged on August 24. One was from an ovum laid on July 2. It emerged on September 15. In 1953 an ovum laid on September 4 hatched on September 20; another laid on September 14 hatched on October 15. One of these larvae hibernated, and resumed feeding in April 1954.

From the foregoing it would appear that *insulana* is at least partially two-brooded. There is disparity in growth of the same age group, and the winter is passed by larvae of various ages and sizes. The largest of these give rise to the spring adults, the smaller ones to

the late summer contingent. The latter are augmented by individuals of the second brood. *C. inornata insulana* would seem to be midway between the single-brooded *C. kodiak* of northern regions and *C. californica* in the south where two broods is the rule.

Orthosia transparens Grt.

A specimen taken at Royal Oak, on April 22, 1959, laid about 215 ova, singly, or in irregular groups, on the sides of the container.

Ovum

Size .75mm. by .5 mm. A depressed sphere with about 40 vertical ribs whose sides have a bright sheen, varying in intensity with the incidence of the light, a small light brown dot in the micropylar area, and a fine broken ring of the same colour on the shoulder of the egg. Hatched on May 1.

Larva—1st Instar

Length 2.5 mm. Head light brown, sparsely but strongly dotted with black. Body whitish, transparent, with prominent, black, seta-bearing tubercles. The larva consumed part of the chorion, then fed on *Arbutus menziesii* Pursh penetrating into the leaf-bases of the expanding buds.

2nd Instar

May 8. Length 8 mm. Head semi-translucent suffused with white, and dotted with black. Body olive or bluish-green, thin, milky-white dorsal and subdorsal lines, tubercles prominent, black-ringed with white bases, each bearing a stiff hair, spiracular line a vague whitish band, underside concolorous with the upper.

3rd Instar

May 12. Length 15 mm. Appearance as before.

4th Instar

May 16. Length 20 mm. Head near white, blending into a pinkish purple on the vertex, finely reticulated and spotted with brown. Body pinkish brown, thin white dorsal and subdorsal lines, spiracular line light grey centred with an irregular, pale, rust-coloured suffusion, underside a sordid flesh colour, the whole body finely spotted with black.

5th Instar

May 20. Length 28 mm. Appearance similar to 4th instar larva. Body a general sienna brown matching the twigs of the arbutus, tubercles black, edged with white. The larvae fed at night, hiding by day among the debris at the bottom of the container.

6th Instar

May 27. Length 40 mm. Head pale sienna brown, dorsal and subdorsal lines indicated by very thin whitish lines, spiracular line inconspicuous, body finely speckled with white and fuscous dots.

May 31. Length 45 mm. The larva by now full grown, general colour a drab flesh, faintly tinged with reddish-purple, without noticeable markings except suffused dark dorsal and subdorsal lines.

During the period between May 31 and June 14 the larvae became restless and moved continually feeding lightly now and then, but obviously having an urge to travel before pupation. Some larvae had made pupal cells by June 6, in which they lay quiescent without pupating until a week later.

Pupa

Size 15 mm. by 5 mm. Smooth, shiny, the wing cases finely etched with minute, close-set lines. Abdominal segments finely punctate on the anterior margins, light mahogany brown. Cremaster consisting of two very thin, nearly straight spines with four short hairs with knobbed tips at the base, all set upon a shiny boss party sunk into the tip of the last segment.

In 1958 the preferred food plant was unknown until too late; one or two larvae were reared to the 5th instar on Garry oak, which was evidently not relished. By the time arbutus was provided the survivors were too weak to complete their metamorphoses.

SEASONAL FLIGHT ACTIVITY OF THE AMBROSIA BEETLE, TRYPODENDRON LINEATUM (OLIV.), FOR 1959, NEAR PARKSVILLE, B.C.[1]

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Introduction

Hadorn (1933) reviewed earlier work on the flight periods of *Trypodendron lineatum* (Oliv.) and contributed further information on this subject. Prebble and Graham (1957) outlined the biology of this and other ambrosia beetles found on the west coast of Canada. More recently, the seasonal flight activity of *T. lineatum* in the Lake Cowichan, B.C. area has been the subject of special investigation (Chapman and Kinghorn, 1958; see also Kinghorn and Chapman, 1959). In 1959 some further data were secured on this phase of the beetles' activity, to assist in carrying out and interpreting chemical control and various biological studies. It seems worth while to place this information on record.

Methods and Results

Through the co-operation of the Pest Control Committee of the B.C. Loggers' Association, two areas (logging settings) of approximately 20 acres each, on which all trees had been felled and cut into logs, were made available for an experiment on protection of logs from ambrosia beetle attack by helicopter - applied spray. One area was sprayed and the other, near-by, left untreated to serve as the control. The latter was also used for studies on seasonal development and biology of *T. lineatum*.

The experimental settings were situated on land owned by the MacMillan, Bloedel and Powell River Company, some seven miles south of Parksville, B.C., at an altitude of about 1,200 feet. The trees on both settings had been cut in December 1958 and were, presumably, suitable for *Trypodendron* attack in the spring of 1959. Much of the land surrounding these two settings and the intervening block of timber was clear, having been logged in previous years. In this area the land slopes rather gently to the north and there are no marked topographical features.

The several methods used to secure information on relative numbers of beetles in flight during the season will be described briefly. The information secured by each method is presented in Figure 1, together with weather data taken from the Department of Transport weather station at Cassidy (Nanaimo Airport), about 20 miles from the test area and near sea level.

Glass barrier flight traps, used in earlier studies (Chapman and Kinghorn, l.c.), were placed over felled logs at widely spaced positions, eight in the sprayed and eight in the control area. Collections were made from them throughout the season at intervals of one to seven days (C). The numbers of beetles in all records are averages, representing the number collected divided by the days since the previous collection. About the time beetles began to emerge from some of the logs after brood-rearing activity or development, two other sets of traps were placed in the control setting; four next to logs known to be attacked by the earliest beetle flights (F), and eight intended to reveal any movement of beetles into a block of timber between the spray and control settings (five outside and three within the timber)—(E).

Thirty-two collecting pans (Chapman and Kinghorn, l.c.) were placed

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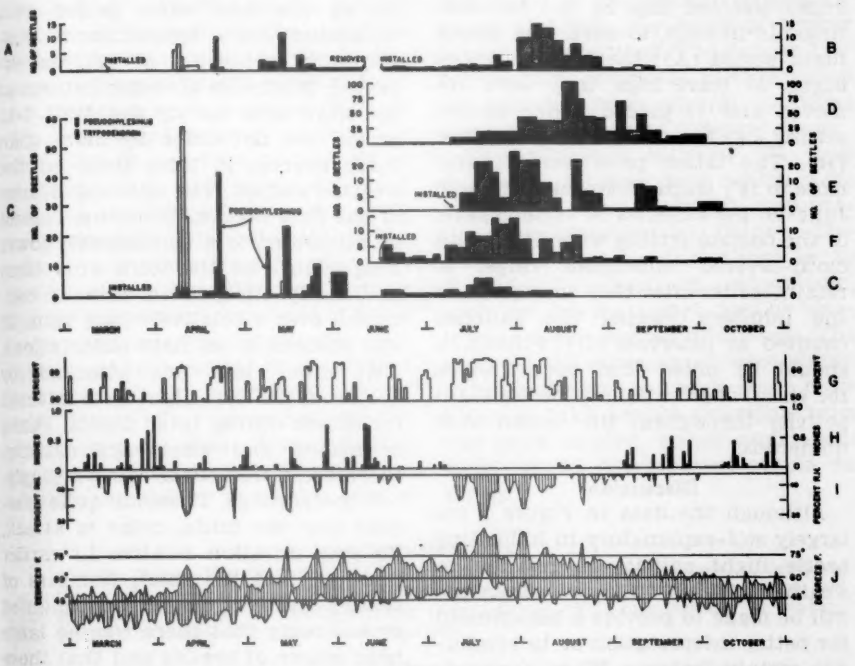

Fig. 1.—Numbers of Trypodendron taken in relation to weather and time of season. (A) and (B) from collecting pans under logs; (C), (E) and (F) from glass barrier traps; (D) from retaining cages on established galleries; (G) sunlight over 50 per cent of that possible; (H) precipitation in inches; (I) minimum relative humidity when below 50 per cent; (J) maximum and minimum temperatures (see text; all weather data based on daily values). In (C) the lesser catches of Pseudohylesinus relative to Trypodendron on some days are indicated by arrows.

under selected logs in the two settings, 16 in each, to cover the attack flight period (A); then, when beetles began to leave logs, they were removed and 16 placed under control setting logs known to be well attacked (B). The latter pans were located close to (F) traps. Between May 6 and June 10, 138 galleries in various parts of the control setting were fitted with cloth-covered aluminum rings, to retain beetles after they emerged, and the numbers leaving the galleries counted at intervals (D). Finally, it should be noted that opportunities for visual observations of beetle flight activity throughout the season were numerous.

Discussion

Although the data in Figure 1 are largely self-explanatory in indicating beetle flight activity in relation to weather and season, a few comments will be made to provide a background for better intepretation or to emphasize certain features. When comparisons are made or implied they refer to the previous Cowichan Lake area work and the conclusions based upon it.

The sunlight record (G) shows only the duration of sunlight over 50 per cent of that theoretically possible for each day at that latitude. It is felt that this shows more clearly than would the total hours of sunlight per day, the occurrence of sunny intervals during the season. This record, together with those of the daily maximum and minimum temperatures (J), precipitation (H), and minimum relative humidity on days when this fell below 50 per cent (I), shows fairly well the nature of the weather at various times during the season.

The numbers of beetles active about these logging settings and the resulting attack densities were relatively low compared with those encountered in previous studies. Moreover, the first beetles did not appear in the area during the first warm period with maximum daily temperatures substantially exceeding 60° F., as expected. Maximum air temperatures at the work area during the April 7-11 period did not differ by more than three degrees F. from those at the weather station. The slow appearance of the first beetles, therefore, cannot be attributed to a considerably lower temperature at the work area than at Cassidy. Also, beetle attacks continued over a relatively long time. It was obvious, from field observations, that many logs not attacked by beetles of the first flight were selected for attack during later flights. Peaks of attack and emergence activity, therefore, were not the same throughout the settings. It seems quite possible that the initial delay of attack, its long duration relative to earlier findings, and the small numbers of beetles involved, can all be explained by assuming that there was no large near source of beetles and that those reaching the area had come from distant and scattered sources. The logging history within a radius of about five miles of the area supports the suggestion that near-by forests harboured relatively few beetles.

It is of interest that *Pseudohylesinus* spp. again served as an indicator for *Trypodendron* by appearing shortly before, as well as during, its early flights. Also, the glass barrier traps and the pans under logs gave, in spite of the small numbers of beetles, substantially the same picture of times of attack (A and C).

There is general agreement between the various measures of beetle flight from logs after brood - rearing or development. The main feature of this movement to be noted is its long duration. One factor which probably contributed to differences in the pattern of emergence shown in Figure 1 is the previously mentioned variability in the times at which logs were

attacked in different parts of the setting. Without doubt the duration of gallery construction and egg-laying activity differed in the various logs, also. The data represented at (B) and (F) were based largely on logs attacked by the earliest flights. Many of these logs had unusually long galleries and young beetles were still being produced relatively late in the season. The data in (C) represent pooled catches throughout both spray and control settings, but none of these traps were near logs which were attacked and they cannot be considered to represent the emergence period well. Item (E) represents beetles emerging near those traps of this group which were in the open and, in addition, movement of beetles from a large part of the control setting towards and into the block of timber between the settings. The data in (D) represent a composite picture based on galleries from several locations and logs attacked at different times.

The difference between (F) trap data and (B) pan data, which were taken in the same location, may perhaps be explained as follows. The traps were set up just above or to one side of the logs and, undoubtedly, took, for the most part, beetles leaving the upper surface of the logs. The pans, on the other hand, were placed beneath the logs and were much more likely to take beetles emerging from the more shaded, cooler under-portions where development would be slower.

Acknowledgments

We would like to thank M. Jackson and G. Richardson for help in carrying out this study, and the Pest Control Committee of the B.C. Loggers' Association and the MacMillan, Bloedel and Powell River Company for their co-operation in making the settings available for these investigations.

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A Note on **Eulonchus tristis** Lw. (Diptera: Cyrtidae)

Eulonchus tristis Lw. is fairly common in the southern Kootenay region of British Columbia; Mr. H. R. Foxlee has collected many specimens in the vicinity of Robson and I have taken a few at Remac, Ainsworth, and Champion lakes. The adults frequent flowers, particularly those of queenscup, **Clintonia uniflora** Kunth.

Eulonchus tristis is a strong flier, and is capable of some unusual aerobatics. On June 13, 1959, near Remac, four of these flies, clinging together in a tight ball and producing a loud discordant buzz, flew past me and were gaining altitude and avoiding various obstacles before being netted. There were three males and one female.

The ability of insects in several orders to fly while copulating is so well developed that it scarcely merits attention; but this instance of four individuals combining to form a single airborne unit is, I think, remarkable.

—*J. Grant, Forest Biology Laboratory, Vernon, B.C.*

THE CORIXIDAE (HEMIPTERA-HETEROPTERA) OF BRITISH COLUMBIA

I. LANSBURY[1]

Introduction

Prior to this list nineteen species were recorded from British Columbia; twenty five are recorded here and three new species are described. Some of the records are from Hungerford (1948) and Lansbury (1955). The remainder are from material in the collections of the Department of Zoology at the University of British Columbia, Vancouver. Full descriptions of the species listed, excluding the new ones, can be found in Hungerford (1. c.).

List of Captors

A.B.A.	A. B. Acton
L.D.A.	L. D. Anderson
K.F.A.	K. F. Auden
W.B.	W. Bennedict
J.C.B.	J. C. Bradley
O.B.	Owen Bryant
E.R.B.	E. R. Buckell
D.C.B.	D. C. Buckland
B.C.	Bueno Coll
G.C.C.	G. C. Carl
N.C.	N. Carter
W.D.	W. Downes
J.F.	J. Fraser
A.N.G.	A. N. Gartrell
J. H.	J. Hart
J.K.J.	J. K. Jacob
H.B.L.	H. B. Leech
C.C.L.	C. C. Loan
V.Z.L.	V. Z. Lucas
J.A.M.	J. A. Munro
P.	Parshley
J.H.P.	J. H. Pepper
W.H.P.	W. H. Preece
G.G.E.S.	G. G. E. Scudder
G.S.S.	G. Stace Smith
G.J.S.	G. J. Spencer
A.T.	A. Thrupp
U.C.	Uhler Coll
P.N.V.	P. N. Vroom
J.B.W.	J. B. Wallis
J.W.	J. Waterfield
N.S.W.	N. S. Wright

Species Recorded

Cymatia americana (Hussey)

Kamloops (G.J.S.); Brent Lake, Summerland (A.N.G.); Fort St. John (A.B.A.); Nulki Lake near Vanderhoof (J.A.M.). This species has also been collected in the North West Territory, Manitoba, Alberta, Saskatchewan and Alaska. Apparently not very common although widespread.

Dasycorixa hybrida (Hungerford)

Vernon (P.) (Hungerford, 1.c.).

Corisella decolor (Uhler)

Osoyoos (H.B.L.); Hope (L.D.A.). British Columbia forms the extreme northern limit of this species; it occurs abundantly in California, Utah, Nevada and Oregon.

Callicorixa audeni (Hungerford)

Kamloops (G.J.S.); Fraser Lake (G. J. S.); Chilcotin (G.J.S.); Nicola (G.J.S.); Australian (N.S.W.); Midday Valley, Merritt (K.F.A.); Oliver (W. D.); Williams Lake District (G.G.E.S.); Alkali Lake South of Clinton (G.G.E.S.); Soda Creek, to light (G.J.S.); Nulki Lake near Vanderhoof (J. A. M.); Downie Creek, Selkirk Mountains (J.C.B.); Prairie Hills (J.C.B.); Paxton Valley (A.T.); Keremeos (C.C.L.); Westbank (A.N.G.); Jesmond (J. K. J.); Nr. Clinton (A.B.A.); Fort St. John (A.B.A.); 45 miles N. of Atlin (A.B.A.); Revelstoke.

Callicorixa alaskensis (Hungerford)

Seymour Mountain 4,000 feet, Vancouver (H. B. L.); Masset, Q.C.I. (A.B.A.); 20 miles south of Port Clements, Q.C.I. (A.B.A.); Tlell, Q.C.I. (A.B.A.); Fort St. John (A.B.A.); Atlin (A.B.A.). Hungerford (1.c.) also lists B.C. but no locality is given. This species is most common in Alaska.

Callicorixa vulnerata (Uhler)

Saanich (W.D.); Milner (G.J.S.); Pond, Univ. B.C. (G.J.S.); Mission (W.D.); Point Grey (J.H.); Malahat (W.D.); Metchosin (W.D.); Bear Foot Mts. (B.C.); Peachland (A.N.G.); Penticton (A.N.G.); Port Clements, Q.C.I. (A.B.A.); Tlell, Q.C.I. (A.B.A.); Masset, Q.C.I. (A.B.A.); 20 miles south of Port Clements, Q.C.I. (A.B.A.). Recorded from scattered localities in the Western United States.

[1] Hope Department of Entomology, University Museum, Oxford.

Cenocorixa bifida (Hungerford)
Kamloops (G.J.S.); Chilcotin (G.J.S.); Nicola (G.J.S.); Malahat (W.D.); Vernon (E.R.B., W.D.); 6 miles South of Clinton (G.G.E.S.); 149 mile lake, Cariboo (G.G.E.S.); Soda Creek, to light (G.J.S.); Milner (G.J.S.); Westwick Lake, Cariboo (G.G.E.S.); Riske Creek, North Range (G.G.E.S.); Boitano Lake, Cariboo (G.G.E.S.); Peachland (J.B.W.); Nulki Lake (J.A.M.); Westbank (A.N.G.); Summerland, Fish Lake (A.N.G.); Oliver (A.N.G.); Hope Mt., 4,500 feet (A.N.G.); Jesmond (J.K.J.); Minnie Lake (N.C.); Nicola (P.N.V.). This is an extremely common species over the Plateau region, most common in Montana in the United States.

Cenocorixa utahensis (Hungerford)
Vernon (W. D.); Windermere (O.B.); Copper Ht. (G.J.S.); Brent Lake, Summerland (A.N.G.); Penticton (A.N.G.). British Columbia seems to be the northern limit of this Corixid.

Cenocorixa andersoni Hungerford
Victoria (K.F.A.); Goldstream (K.F.A.). Not hitherto recorded from Canada; known only from Oregon and Washington where it is not very common.

Cenocorixa expleta (Uhler)
Kamloops (G.J.S.); 6 miles South of Clinton (G.G.E.S.); Riske Creek, North Range (G.G.E.S.). Not previously recorded from British Columbia; found most commonly in North Dakota and also known from Manitoba and Saskatchewan.

Hesperocorixa laevigata (Uhler)
Kamloops (G.J.S.); Vernon (W.D.); Pond, Univ. B.C. (V.Z.L.); Osoyoos (H.B.L.); Vancouver (H.B.L., G.J.S.); Nicola (G.J.S.); Metchosin (W.D.); Midday Valley, Merritt (K.F.A.); Mission (W.D.); Oliver (W.D.); Point Grey (J.H.); Alkali Lake South of Clinton (G. G. E. S.); Riske Creek, North Range (G. G. E. S.); Cariboo (G.G.E.S.); Peachland (J.B.W., A.N.G., H.B.L.); Chilliwack; Cranbrook (J.H.P.); Sahacks Lake (U.C.); Victoria, Swan Lake (A.B.A.). Apparently an abundant species in the lower part of the province. Found over most of the United States, but not very common along the Eastern seaboard; it has been recorded from Mexico.

Hesperocorixa vulgaris (Hungerford)
Oliver (W.D.); Williams Lake district (G.G.E.S.); Cranbrook (O.B.); Sooke (K.F.A.); Clinton district, Beaverdam Lake (H.B.L.). Seemingly on the edge of its distribution, this Corixid is found principally in Michigan and Minnesota and there are records for most of the United States.

Hesperocorixa michiganensis (Hungerford)
Saanich (W.D.); Chilcotin, Riske Creek (G.G.E.S.). Found in scattered localities across Canada, but not along the Eastern seaboard.

Hesperocorixa atopodonta (Hungerford)
Saanich (W.D.); Riske Creek, North Range (G.G.E.S.). A new record for British Columbia, this species is found most commonly in Michigan, Minnesota and Wisconsin.

Arctocorisa convexa (Fieber)
Revelstoke (Walley, 1936). Known in B.C. only from this locality. Found principally so far in Labrador.

Arctocorisa sutilis (Uhler)
Kamloops (G.J.S.); 45 miles N. of Atlin (A.B.A.). Not previously recorded from British Columbia. This *Arctocorisa* has a wide distribution extending from Alaska to Colorado.

Sigara (Arctosigara) decoratella (Hungerford)
Kamloops (G.J.S.); Lac la Jeune (A. C. T.); Smithers; Chilcotin (G.J.S.); Oliver (P.N.V.); Shafer Lake (J.A.M.); Nicola Lake (E.R.B.). Not a common species; the main centre of distribution is Michigan and Minnesota.

Sigara (Arctosigara) penniensis (Hungerford)
Prince Rupert (N.C.).

Sigara (*Vermicorixa*) *bicoloripennis* (Walley)

Chilcotin (G.J.S.); Cariboo, Westwick Lake (G.G.E.S.); Brent Lake, Summerland (A.N.G.). Found mainly in Manitoba, Michigan and Minnesota.

Sigara (*Vermicorixa*) *washingtonensis* Hungerford

Windermere (O.B.); Adams Lake (K.F.A.); Vernon (L.D.A., W.D.); Oliver (L.D.A.); Quesnel Lake (W.B.); Needles (H.B.L.); Mill Creek, Kelowna (A.N.G.). A fairly common species in British Columbia, although this province appears to be the northern limit.

Sigara (*Vermicorixa*) *grosslineata* Hungerford

Quesnel (G. J. S.); Burns Lake (G.J.S.). Not previously recorded from British Columbia. Recorded principally from Manitoba in Canada and over the greater part of the United States, but with few records for the seaboard areas.

Sigara (*Vermicorixa*) *solensis* (Hungerford)

Quesnel (G.J.S.); Shuswap (G.J.S.); Nulki Lake (J.A.M.); 16 Mile Lake (J.A.M.); Seymour Lake (J.A.M.). Not very common; has a discontinuous distribution over Canada and the United States.

Sigara (*Vermicorixa*) *omani* (Hungerford)

Metchosin (W.D.); Malahat (W.D.); Stanley Park (G.J.S.); Prince Rupert (N.C.); Saanich (W.D.); Chilliwack; Port Clements, Q.C.I. (A.B.A.). A common species. Distribution in the United States is confined to the western seaboard of Washington, California and Oregon.

Sigara (*Phaeosigara*) *dolabra* Hungerford & Sailer

Lagoon (G.C.C.). A new record for British Columbia. This is an exceedingly rare species. The distribution elsewhere is Minnesota, Michigan, Rhode Island and Newfoundland.

Sigara (*Vermicorixa*) *mulletensis* (Hungerford)

Chief Lake (J.A.M.). Found principally in Michigan and Minnesota.

Cenocorixa hungerfordi n. sp. Fig. 1

Size: length 7.7 mm. to 8 mm.; width of head across eyes 2 mm. to 2.1 mm.

Colour: general facies light; pronotum crossed by 8 to 10 dark lines narrower than the pale interlineations, the median dark lines being broken in the centre of pronotum; claval pattern broken, vermiculate dark splotches with colour etched away from inner angle; corial pattern vermiculated dark splotches arranged in three indistinct longitudinal series; membrane and corium distinctly separated by pale smoky line; embolium, head and limbs pale, venter pale to black.

Structural characteristics: Head half as long as pronotal disk, interocular distance greater than the width of an eye (about 25%); vertex of male as seen from above produced slightly medianly beyond margins of eyes; facial hairs few, male fovea broad attaining margins of eyes; fovea well defined but not deep, overhung medianly by projection of vertex; pronotal disk with median carina visible on anterior fifth, moderately rastrate; hemelytra rugulose with few pale hairs; pruinose area of embolar groove posterior of nodal furrow subequal in length to that of claval suture; lateral lobe of prothorax elongate, slightly pointed distally; mesepimeron narrow, osteole near tip; metaxyphus slightly longer than broad, pointed apically.

Front leg of female of typical shape, with about 19 hairs on lower palmar row.

Front leg of male: Pala slightly longer than broad at widest point; peg row broken, 12 pegs in basal portion, 3 large pegs separated from each other and those of the basal and

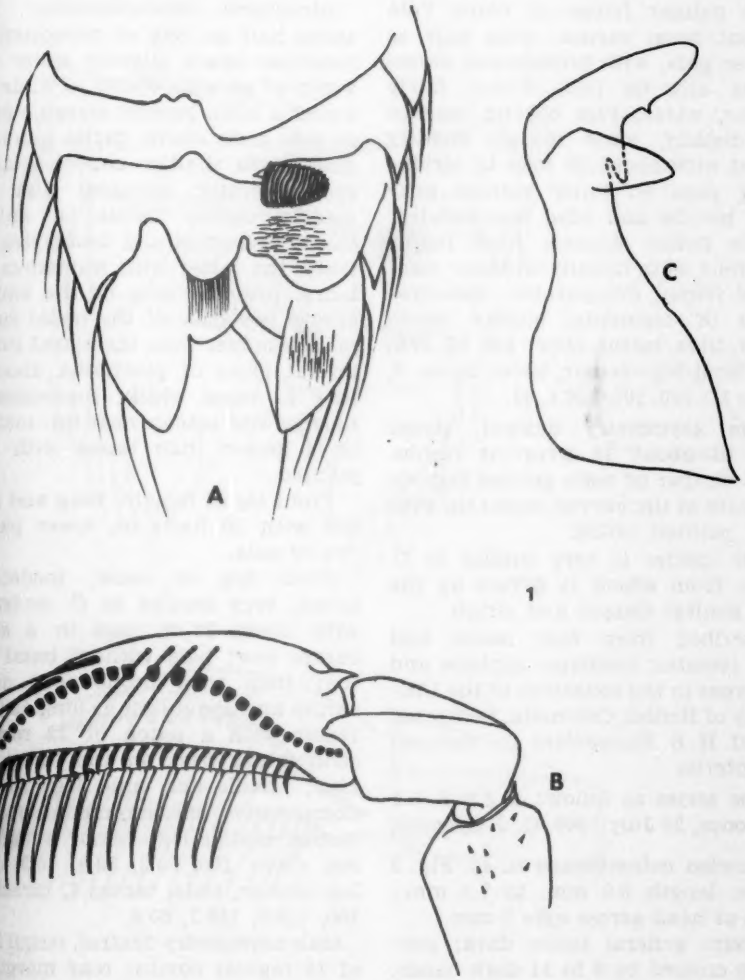

Fig. 1.—*Cenocorixa hungerfordi*. A Dorsal view of male abdomen. B Front leg of male. C Right clasper of male.

distal portion by 1½ to 2 times their own width; 12 pegs in distal portion. There are also 4 long hairs on upper part of median area of pala reaching lower palmar fringe of hairs. Pala without basal carina; tibia half as long as pala, with pronounced dorsal carina and no pad; femur fairly slender, widest just beyond median line distally, inner margin slightly curved with about 15 rows of stridulatory pegs on inner surface near base; middle and hind legs slender; middle femur spinose; hind femur with four teeth distally on inner margin of femur. Comparative measurements of segments, middle leg — femur, tibia, tarsus, claw: 100, 56, 37.5, 46.6; hind leg—femur, tibia, tarsus I, tarsus II: 100, 105, 126.1, 63.

Male asymmetry dextral, strigil large of about 13 irregular combs. Right clasper of male genital capsule bifurcate at tip, curved, distal tip with small pointed notch.

This species is very similar to *C. bifida*, from which it differs by the right genital clasper and strigil.

Described from four males and eight females; holotype, allotype and paratypes in the collection of the University of British Columbia. Dedicated to Prof. H. B. Hungerford the eminent Hemipterist.

Type series as follow: 4 ♂♂ 8 ♀♀ Kamloops, 29 July 1945, G. J. Spencer.

Cenocorixa columbiensis n. sp. Fig. 2

Size: length 6.9 mm. to 7.1 mm.; width of head across eyes 2 mm.

Colour: general facies dark; pronotum crossed by 9 to 11 dark bands, rarely 8, about the same width as the pale interlineations, dark bands broken medianly; claval pattern, apical portion more or less regularly transverse, basal portion more irregular; corial pattern vermiculate dark figures with somewhat vague longitudinal series; membrane and corium clearly separated by a pale line; embolium pale to smoky; rear and fore legs suffused with reddish brown, limbs a little paler; venter pale at margins, dark to smoky over remainder.

Structural characteristics: Head about half as long as pronotum; interocular space slightly wider than width of an eye; vertex of male produced a little beyond margins of eye as seen from above; facial hairs few; male fovea shallow almost attaining eyes laterally; pronotal disk with median carina visible on anterior third; pronotum and hemelytra rastrate, the latter with numerous pale hairs; pruinose area of the embolar groove posterior of the nodal furrow plainly longer than the claval suture; lateral lobes of prothorax about as long as basal width; mesoepimeron narrow with osteole near tip; metaxyphus longer than broad with apex pointed.

Front leg of female: long and slender with 20 hairs on lower palmar row of pala.

Front leg of male: moderately broad, very similar to *C. andersoni* with about 29/30 pegs in a single curved row; pala without basal carina; tibia with pronounced dorsal carina and about half as long as pala; femur with a patch of 12 rows of stridulatory pegs on the inner surface; middle and hind legs slender. Comparative measurements of segments: middle leg—femur, tibia, tarsus, claw: 100, 58.3, 38.9, 46.3; hind leg—femur, tibia, tarsus I, tarsus II: 100, 116.6, 118.1, 60.6.

Male asymmetry dextral, strigil large of 12 regular combs; rear margin of the seventh abdominal segment of the male with three lobes; right clasper of male not bifurcate at tip; seventh ventral abdominal segment of female broadly incised at tip.

This species can be separated from the remainder of the genus by the male genitalia, the number of dark lines on the pronotum and the fact that the hind tibia and tarsus I are

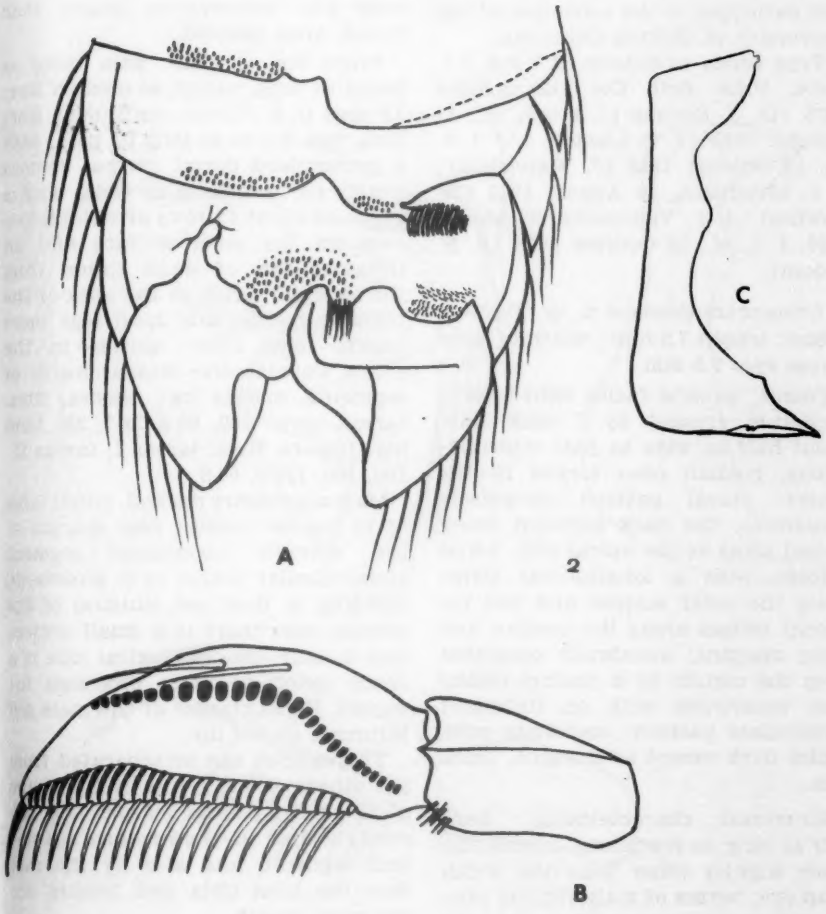

Fig. 2.—Cenocorixa columbiensis. A Dorsal view of male abdomen. B Front leg of male. C Right clasper of male.

almost the same length whereas in *C. andersoni* tarsus I is considerably longer than the tibia.

Described from eight males and twelve females. Holotype, allotype, and paratypes in the collection of the University of British Columbia.

Type series as follows: 6 ♂♂ 6 ♀♀, Pond, Univ. Brit. Col., 12 October 1928 (G. J. Spencer); 3 ♀♀, *id.*, 11 October 1928 (V. Z. Lucas); 1 ♂ 1 ♀, *id.*, 12 October 1928 (J. Waterfield); 1 ♀, Metchosin, 30 August 1919 (W. Downes); 1 ♂, Vancouver, 27 March 1929, 1 ♀, *id.*, 10 October 1925 (P. N. Vroom).

Cenocorixa downesi n. sp. Fig. 3

Size: length 7.5 mm.; width of head across eyes 2.5 mm.

Colour: general facies light brown; pronotum crossed by 7 dark lines about half as wide as pale interlineations, median ones forked in the centre; claval pattern irregularly transverse, the dark pigment being etched away at the apical end; corial pattern with a longitudinal stripe along the outer margin and two incipient stripes along the median and inner margins; membrane separated from the corium by a distinct smoky line; membrane with an indistinct vermiculate pattern; embolium pale, venter dark except at margins, limbs pale.

Structural characteristics: head half as long as pronotum, interocular space slightly wider than the width of an eye; vertex of male slightly produced beyond margins of eye as seen from above; facial hairs very few, male fovea shallow almost attaining lateral margins of eye; pronotal carina visible only on anterior fifth; pronotum and hemelytra moderately rastrate, hemelytra with numerous pale long hairs; pruinose area of the embolar groove posterior of the nodal furrow 25 per cent longer than that of the claval suture; lateral lobe of the prothorax one third longer than broad at widest point, tip truncated; mesoepimeron narrow with osteole near tip; metaxyphus longer than broad, apex pointed.

Front leg of male: pala twice as broad as long, widest at median line; 32 pegs in a curved continuous line; tibia two thirds as long as pala, with a pronounced dorsal carina; femora nearly twice as long as tibia, with a patch of about 12 rows of stridulatory pegs on the inner surface and an irregular row of small spines from the stridular patch to the apex of the femora; middle and hind legs more robust than other species in the genus. Comparative measurements of segments, middle leg: femora, tibia, tarsus, claw: 100, 60.9, 38.7, 36; hind leg: femora, tibia, tarsus I, tarsus II: 100, 100, 127.6, 54.6.

Male asymmetry dextral, strigil large of 15 regular combs; rear margin of the seventh abdominal segment rather similar to that of *C. andersoni*, differing in that just sinistral of the median lobe there is a small projection basally. On the dextral side is a dense patch of hairs produced inwardly. Right clasper of the male not bifurcate at the tip.

This species can be separated from the others of the genus by the shape of the right genital clasper and the configuration of the seventh abdominal segment, and also by the fact that the hind tibia and femora are the same length.

Known only by the male type from Stanley Park collected by T.T.W.M., 8 October 1925. Type in the collection of the University of British Columbia. Dedicated in honour of W. Downes who in his life time did so much to advance our knowledge of the Hemiptera of British Columbia.

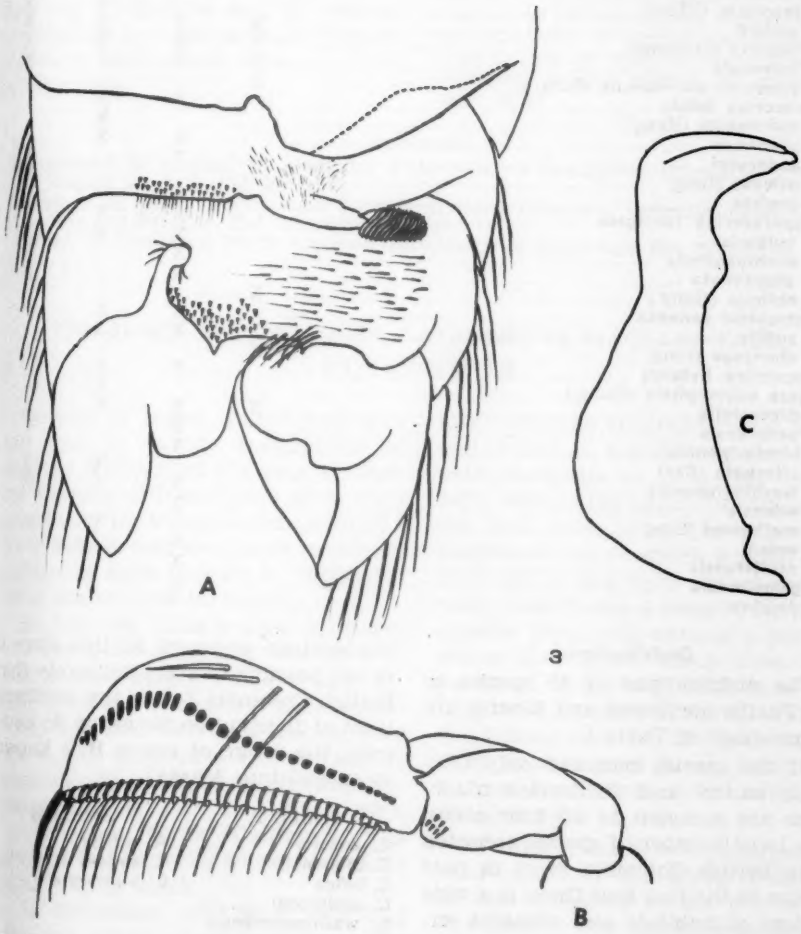

Fig. 3.—Cenocorixa downesi. A Dorsal view of male abdomen. B Front leg of male. C Right clasper of male.

TABLE I—Distribution of Corixid species in the Pacific northwest and Alberta exclusive of new species.

	Alaska	B.C.	Alta.	Wash.
Cymatia americana	X	X	X	
Trichocorixa naias (Kirk.)			X	
Corisella decolor		X		
C. inscripta (Uhler)				X
C. audeni	X	X	X	X
Callicorixa alaskensis	X	X	X	X
C. vulnerata	X	X		X
C. producta norvikensis Hung.	X			
Cenocorixa bifida		X	X	
C. dakotensis (Hung.)			X	
C. utahensis		X	X	
C. andersoni		X		X
C. wileyae Hung.				X
C. expleta		X		
Hesperocorixa laevigata		X	X	X
H. vulgaris		X	X	X
H. michiganensis		X		
H. atopodonta		X		X
H. obliqua (Hung.)	X			
Arctocorisa convexa		X	X	
A. sutilis	X	X	X	
A. chanceae Hung.	X			
Dasycorixa hybrida		X	X	
Sigara conocephala (Hung.)			X	
S. decoratella	X	X	X	
S. penniensis		X		
S. bicoloripennis		X		
S. alternata (Say)			X	X
S. washingtonensis		X	X	X
S. solensis		X		
S. mathesoni Hung.			X	
S. omani		X		
S. mulletensis		X		
S. grosslineata		X		
S. dolabra		X		

Distribution

The distributions of 35 species in the Pacific northwest and Alberta are summarised in Table I.

Of the species recorded only *Corisella audeni* and *Callicorixa alaskensis* are common to all four areas. The large number of species recorded from British Columbia must in part be due to the fact that there is a wide variety of habitats and climates enabling such genera as *Corisella, Arctocorisa* and *Dasycorixa* to occur although none of these genera are very abundant. It must, however, be borne in mind that great areas of this province have never been collected.

The known Corixids of British Columbia can be divided into four categories according to their distribution in America north of Mexico.

I. Species principally confined to the western seaboard. At this stage it is not possible to state definitely that British Columbia forms the northern limit of distribution for group A; however, the range of group B is known to extend into Alaska:

Group A	Group B
C. decolor	**A. sutilis**
C. utahensis	**C. audeni**
C. bifida	**C. vulnerata**
C. andersoni	
S. washingtonensis	
S. omani	

II. Species with a predominantly trans-Canadian distribution:

A. convexa **C. americana**

III. Species distributed across Canada, and north central plains of the United States:

C. alaskensis	**S. decoratella**
H. vulgaris	**S. penniensis**
H. michiganensis	**S. bicoloripennis**
H. atopodonta	**S. solensis**
	S. mulletensis

IV. Species recorded from most of Canada and found in most of the United States:

H. laevigata S. grosslineata

The remaining three species, *D. hybrida*, *S. dolabra* and *C. expleta*, are difficult to comment upon regarding their distribution because of the lack of data.

Acknowledgements

I wish to acknowledge the assistance of Prof. H. B. Hungerford of the University of Kansas for help in the determination of certain species of **Cenocorixa** and **Sigara dolabra**. I also wish to thank Dr. G. G. E. Scudder, of the Department of Zoology at the University of British Columbia, for allowing me to examine the University collections and for reading and criticising these notes.

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THE BLACK WIDOW SPIDER, LATRODECTES MACTANS FABR., IN VANCOUVER

Spiders of many shapes and sizes are sent in to the Department of Zoology throughout the year by fearful citizens with enquiries as to their propensity for killing human beings: I have always told them that no deadly poisonous spider occurs in Vancouver or in the wet coastal region.

In the mid 1950s a dead specimen in very poor condition was sent in which resembled a Black Widow except that the abdomen was conspicuously marked with pale bands, very much like those of a typical male *L. mactans*, in contrast to all those females I have seen in the dry belt, those from Davis, California and those from Victoria, whose abdomens were totally black.

In December, 1959 when checking the low crawl space under a small house in east Vancouver for termite damage, I found 2 sprawling webs of coarse silk and 2 mature female spiders which were undoubtedly *mactans*, with pale linear markings on the dorsum of the abdomen: they ran into holes from which I failed to retrieve them.

In January, 1960 I was assessing termite damage in the basement of a large house on Granville Street south and found a female *mactans* with pale markings in a typical coarse web, between the edge of a carpet and the wall, just under the edge of a Hollywood bed on which 3 small children and a dog were accustomed to play; nearby was a male in its much smaller web; both were in a position where they could easily have been squashed by a child. Both were captured and brought to the laboratory; the female soon ate the male and in time became coal black except for one small pale spot on the dorsum of the abdomen.

Hitherto I have always given the distribution of the Black Widow in British Columbia as the dry belt of the Interior and the drier sections of Vancouver Island from Victoria to Nanaimo, and on the dry Gulf Islands; this distribution will have to be revised to include at least Vancouver in the lower mainland. If it increases in Vancouver it will constitute a definite hazard and the public will have to be alerted to watch out for it.

—G. J. Spencer, University of British Columbia, Vancouver.

EFFECT OF SPEED OF TRAVEL ON THE PERFORMANCE OF CONCENTRATE ORCHARD SPRAYERS[1]

A. D. McMECHAN,[2] J. M. McARTHUR[3] AND K. WILLIAMS[3]

Introduction

For several years the official recommendation for British Columbia fruit growers has been to operate concentrate sprayers at a speed of one mile per hour in mature plantings with rows 30 feet apart (3). This recommendation was necessary because, when travelling at a faster speed, many of the sprayers did not give good spray coverage in the tree tops. During the last few years most of the concentrate orchard sprayers manufactured in British Columbia have been improved to the point where it should be feasible to operate them at higher speeds. In experiments carried out by Messrs. D. B. Waddell and J. M. McArthur at the Summerland Research Station (unpublished work) it was determined that an efficient concentrate sprayer gave as good deposits at two miles per hour as at one mile per hour, in pre-bloom sprays in large apple trees. In the work reported here, two makes of sprayers were operated at one, and two, miles per hour, for applying summer sprays, and a comparison was made of the spray deposits in the trees at the two speeds.

Methods

Two concenctrate sprayers in common use in British Columbia orchards were used for the experiment. Sprayer A was a single-side sprayer that delivered 7000 cubic feet of air per minute at an average velocity of 115 miles per hour; Sprayer B was a double-side sprayer that delivered 10,300 cubic feet of air per minute per side at an average velocity of 87 miles per hour.

The experiment was carried out in three parts. In May, and August, of 1956 Sprayer A was used to apply DDT to replicated plots of mature McIntosh apple trees in three orchards, at speeds of one, and two miles per hour. The plots that were sprayed at one mile per hour received 72 gallons of spray mixture per acre, and those sprayed at two miles per hour, 36 gallons per acre. The per-acre dosage of DDT was the same for all plots. The sprays were applied at a pump pressure of 300 pounds per square inch.

The second part of the experiment was carried out in July 1957, when Sprayer A was used to apply DDT in two orchards of mature McIntosh apple trees at speeds of one, and two, miles per hour. Fifty gallons of spray mixture per acre were applied on all plots at a pump pressure of 75 pounds per square inch.

The third part of the experiment was carried out in the fall of 1957 when both sprayers were used to apply a post-harvest spray of methoxychlor to replicated plots of mature McIntosh apple trees. The sprayers were operated at one, and two, miles per hour with pump pressures of 75, and 300, pounds per square inch. All plots received 50 gallons of spray mixture per acre.

In all the orchards used in the experiments, the trees ranged in height from 18 to 22 feet, and in diameter from 25 to 30 feet. The trees were 30 feet apart in the rows, and the rows were 30 feet apart.

Leaf samples were taken for insecticide deposit analysis after each spray. Fifty leaves were taken from the top, and 50 leaves from the bottom, of each of five trees per plot. Tree-top samples were taken 15 feet above ground level, and tree-bottom

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samples 6 feet above ground level. Sampling technique and sample treatment were the same as reported by Waddell and McArthur (5). DDT was determined by a modified Schechter-Haller procedure (2); methoxychlor was determined by a modified Fairing-Warrington method (1).

Results and Discussion

The results in Tables 1 and 2 show that, in a majority of the plots, the tree-top deposits on leaves were slightly higher at two miles per hour. It is likely, therefore, that, with the sprayers used, pests in the tree tops can be controlled as well at two miles per hour as at one mile per hour.

TABLE 1—DDT Deposits on Leaves (mmg./sq. cm.) with Sprayer A Operated at Two Speeds. Spray Applied at 300 p.s.i. (Average of 10 Determinations.)

		Tree tops		Tree bottoms	
Date	Orchard	1 m.p.h.*	2 m.p.h.**	1 m.p.h.	2 m.p.h.
May,	1	2.5	3.4	8.1	12.0
1956	2	4.6	4.7	9.1	14.2
	3	5.1	3.3	9.4	6.8
	Average	4.1	3.8	8.9	11.0
August,	1	4.1	6.0	6.9	9.4
1956	2	5.6	6.1	9.4	12.1
	3	4.7	4.0	7.3	8.5
	Average	4.8	5.4	7.9	10.0

* Spray applied at 72 gallons per acre.
** Spray applied at 36 gallons per acre.

In general, the tree-bottom deposits were higher at two miles per hour. In concentrate spraying, more spray chemical is usually deposited in the lower parts of the trees than is required for pest control. Evidently this tendency is accentuated when the sprayer speed is increased.

In this experiment the amount of pesticide applied per acre was the same at both speeds. In the sprays applied in May and August, 1956, this was accomplished by using the same nozzle orifices at both speeds, and doubling the concentration of pesticide in the spray liquid applied at two miles per hour. Theoretically, at the two-mile-per-hour rate, there would be only half as many spray drops per unit area of sprayed surface, and each drop would contain twice as much pesticide. This type of distribution of spray chemical is probably satisfactory for the control of mobile pests but may be inadequate for the control of diseases such as apple scab (4). In the remainder of the experiment suitable nozzles were used to apply the same amount of spray liquid per acre at both speeds. It is interesting to note that the relationship between amounts of insecticide deposited at the two speeds was independent of the volume of spray liquid applied per acre and of the pump pressure.

Growers having sprayers with airstream characteristics similar to those of the sprayers used in the experiment can save considerable time, without sacrificing effectiveness of the spray, by spraying throughout the season at a speed of two miles per hour; growers having less efficient equipment should continue to spray at the previously recommended rate of one mile per hour.

TABLE 2—Insecticide Deposits on Leaves (mmg./sq. cm.) with Two Sprayers Operated at Two Speeds. Spray Applied at 50 Gallons per Acre. (Average of 10 Determinations.)

			Pump	Tree tops		Tree bottoms	
Sprayer	Date	Orchard	pressure p.s.i.	1 m.p.h.	2 m.p.h.	1 m.p.h.	2 m.p.h.
A	July,	1	75	2.8	2.9	6.3	6.8
	1957	2	75	4.0	3.2	5.5	7.2
		Average		3.4	3.1	5.9	7.0
A	September,	4	300	2.8	3.6	2.9	4.5
	1957		75	3.3	3.8	3.9	4.4
B	September,	4	300	2.9	2.2	4.3	6.7
	1957		75	2.2	2.6	4.0	9.3

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TWO RECORDS OF IXODES SIGNATUS BIRULA AND ONE OF IXODES URIAE WHITE, MARINE BIRD TICKS

The first Canadian record of *Ixodes signatus* Birula was by Eric Hearle[2] in 1938 from 2 females and 22 nymphs which I had taken from a cormorant at Tofino, Vancouver Island, in 1926. Other records from Cormorant as given by Gregson[1] are 4 nymphs and I larva from Gull Island, 1 female larva from Cowichan Bay and 3 females from Langara Island. Gregson gives also one unusual record of 3 females and 1 nymph from a rosy finch from the Pribilof Islands.

To these records I can now add 2 others, of collections given me by students at the University who have given me ectoparasites from birds and mammals at odd times.

The first collection was made by Rudolf Drent and G. F. van Tets from *Phalacrocorax pelagicus* Pallas, the pelagic cormorant, found dead on 6 May 1959 on Mandarte Island, B.C. and consists of 1 adult engorged female, 3 adult males, 17 male nymphs and 54 female nymphs and 317 seeds or larvae of both sexes, giving the remarkable total of 392 ticks off one bird. The second collection was made by Rudolf Drent from another pelagic cormorant found dead on 2 June 1959 on Mandarte Island and consists of 2 engorged females, 2 partly engorged females, 1 flat female, 1 small and 1 very small female nymphs and 1 female seed or larva, a total of 8 females and no males.

The third record is of *Ixodes uriae* White, the hairy tick, collected by F. H. Fay from the head of *Uria lonvia* s.s. *arra* the Thick-billed Murre, in June 1954 at Gambell, St. Lawrence, Alaska, and consists of 1 engorged female adult and 11 engorged female nymphs of several sizes. The proportion of females to males in these collections, is interesting; in 2 collections there were no males at all; in the large collection the proportion was roughly 3 females to 1 male; in all collections, 1 or at most 2 engorged females seemed to be responsible for the entire infestations. The 3 collections totalled 412 specimens of what are normally, relatively rare ticks. All the material is in the entomological museum at the University.

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—*G. J. Spencer, University of British Columbia, Vancouver.*

A BRIEF HISTORY OF THE TUBER FLEA BEETLE, EPITRIX TUBERIS GENT., IN BRITISH COLUMBIA[1]

H. G. FULTON[2] AND F. L. BANHAM[3]

The tuber flea beetle was first noted in British Columbia in 1940. Damaged potato tubers from Rosedale and Lulu Island on the lower mainland were received by the Entomology Laboratory at Agassiz for diagnosis. These tubers were found to have pimpling injuries in the skin leading to brown worm-tracks immediately below. Similar damage was reported by Cowan (1) in 1927 and described by Webster and Baker (5) in 1929 in Washington. They attributed the injury to feeding by larvae of the eastern potato flea beetle, *Epitrix cucumeris* Harris.

In 1941, flea beetles were collected from areas where the damaged tubers had been grown. Two species were present; one, the western potato flea beetle, *Epitrix subcrinita* (Lec.), was a minor pest of potatoes that had been present for more than 20 years. This species damaged foliage by feeding but was not known to damage tubers. Later observations (4) indicated that larval damage could occur to tubers when large numbers were present. The second species was readily distinguished from *E. subcrinita*, and was assumed to be *E. cucumeris* until specimens sent to the Systematics Unit in Ottawa, were shown to be undescribed. Finally, in 1944, the insect was described by L. G. Gentner (2).

The first published record of this insect was made in Colorado in 1904 (2) where it caused heavy loss. The insect was first recorded in Oregon, Washington, and Nebraska before 1928.

From 1941 to 1943, *E. tuberis* spread throughout the lower Fraser Valley. Heavy damage occurred at Agassiz, Chilliwack, Langley, and Sumas but the damage diminished towards the coast. The Delta region remained virtually free until 1948.

In the southern interior heavy infestations were general in 1951 and 1952. At several places in the Lillooet district in the upper Fraser Valley and at Kamloops, heavy adult populations severely damaged the foliage of tomato, bean, beet, rhubarb and potato plantings.

In 1953, *E. tuberis* was taken at Gilpin 7 miles east of Grand Forks. New locality records were also made at Fauquier and Burton on the Arrow Lakes about 70 miles north of Grand Forks. Both localities were completely isolated from previously known infestations.

By 1958, *E. tuberis* had appeared 90 miles east of Grand Forks at Wynndel on Kootenay Lake.

Except where references are given the data in this paper were taken from the records of the Chilliwack Sub-station (formerly the Agassiz Entomology Laboratory), the Kamloops Entomology Laboratory, and the Provincial Entomologist, Mr. C. L. Neilson, to whom grateful acknowledgement is made. We also wish to thank Dr. H. R. MacCarthy, Head, Entomology Section, Research Branch, Vancouver, who suggested this topic and for his assistance in the preparation of this paper.

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[3] Entomology Laboratory, Kamloops, B.C.

Fig. 1.—Distribution of **Epitrix tuberis** Gent. in British Columbia.

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A FURTHER RECORD OF GRYLLOBLATTA CAMPODEIFORMIS CAMPODEIFORMIS WALKER, IN THE INTERIOR OF B.C.

A further record for the distribution of *Grylloblatta campodeiformis campodeiformis* Walker, is established with the discovery of this insect in the Monashee Mountains east of Lumby, B.C. Two specimens, one male and one female nymph, were found on September 13, 1956, at a road crossing over Tepee Creek approximately two miles north-west of Lightning Peak in the Monashee Mountains. The identification of these specimens was verified by Professor Emeritus G. F. Spencer of the University of British Columbia.

It is interesting to note that along with both of these insects was captured a large Carabidae — *Pemphus angusticollis* verified by Gordon Stace Smith of Creston, B.C.

The specimens were taken from a deep crack in a soft granite boulder on the bank of the creek. The outer slab of the rock was removed and the insects were found among the moss which was growing inside of the rock fissure. It was a bright day and temperature was estimated to be 65°F. although evening temperatures were below freezing. Altitude was estimated at 6,300 feet.

These specimens and the one captured by J. D. Gregson (1938) at Kamloops, B.C. have coal black eyes which is in contrast to the non-pigmented eyes of two adult specimens taken at Jasper (1930) and which are held by Professor G. J. Spencer.

Seven specimens, one adult and six nymphs, were taken by D. K. Campbell and J. Grant and are assumed to be of the same variety, although identification was not confirmed. These specimens were found beneath the rocks, at the foot of a stable talus slope, located on the north-east side of the Monashee highway approximately 32 miles east of Lumby at an elevation of about 3,800 feet. The date of capture was November 11, 1952. At the time of capture the insects were active although air temperature hovered about the freezing point with intermittent snow flurries. The temperature within the rock slide was below freezing. The pigmentation in the eyes of these specimens was not observed.

—*J. Corner, Provincial Apiarist, Vernon, B.C.*

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Fig. 1.—Distribution of **Epitrix tuberis** Gent. in British

SCOLYTID NOTES[1]

J. M. KINGHORN[2]

A. Hosts of *Anisandrus pyri* (Peck) —This ambrosia beetle is a common pest of many species of deciduous trees including most of the common fruit trees. In addition, Essig (1926) lists hemlock, cedar, and pine as hosts. Chamberlin (1939, 1958) states that these coniferous hosts were undoubtedly listed in error.

In a Douglas fir log at Cowichan Lake, B. C., two ambrosia beetle galleries were found which were of the diameter of *A. pyri*. The remains of an insect in one of the galleries was positively identified as a female of the species. In addition, the tunnels were occluded with a fungus. Upon minute examination, the spores of the fungus closely resembled those of the fungal symbiont of *Xyleborus dispar* described by Schneider-Orelli (1913). *X. dispar* is a European species closely related to, and probably synonymous with *A. pyri*.

Although evidence of brood development was not found, the fact that attack did occur in Douglas fir indicates that Essig's coniferous host records should be considered valid.

B. Pupation of *Orthotomicus vicinus* (Lec).—This species is doubtfully distinct from *O. caelatus* (Eichh.) according to Swaine (1918). Near Nanoose Bay, B. C., a white pine log was infested by the insect. The larvae typically destroy most of the inner bark. Pupae and young adults were found during August in the outer bark and in the sapwood. The sapwood pupal cells were of particular interest because this habit is infrequent among bark beetles. The larvae bored radially into the sapwood to a depth equivalent to about their body length, then turned and cut a pupal niche lying parallel with the grain of wood. White frass plugged the entrance. Upon emerging, the teneral adults bored through the frass plugs and directly through the outer bark. The L-shaped pupal cells are like minature replicas of those mined by the cerambycid, *Tetropium velutinum* Lec.

C. Excessive Brood Mortality of *Dendroctonus monticolae* Hopk. — High natural brood mortality of the mountain pine beetle is not uncommon. However, during the course of chemical control studies at Windermere, B. C., from 1951 to 1953, exceptionally high brood mortality during the late larval and pupal stages was often encountered. In June and July, large, apparently healthy larvae were found, but emergence in August was negligible. It was noted that in such trees much fungus mycelium was growing around the galleries in the inner bark. Dead larvae and pupae were often surrounded or completely covered with white mycelium.

An example can be cited from among ten lodgepole pine trees used for checks in a chemical control experiment. The trees were examined for attack and survival in August, 1953. All were infested to about the same degree, and whereas survival in nine of the trees averaged 17.8 $\pm$ 8.7 $(\bar{X} \pm t_{.05} S\bar{X})$ insects per square foot, only an average of 1.4 beetles per square foot survived in the tenth tree. Heavy mycelium was present around the insect galleries in all parts of the infested bole. Blue stain invariably associated with the species was in the sapwood along with an incipient decay. Field culturing facilities necessary for determining the identity of the mycelial mass were not available at the time. Cultures inoculated from the wood in the laboratory later re-

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vealed that the decay fungus was *Peniophora gigantea* (Fr.) Massee. That wood decaying fungus might be implicated in the death of bark beetle broods is worth noting. Heretofore, certain mould fungi *(Erotium, Penicillium* and *Aspergillus)* are reported to have destroyed broods of *Ips* spp. (Trimble, 1924), but the possibility that decay fungi might have a smothering effect on broods has apparently received no attention in North America.

Fungi, other than the commensal bluestains, are so frequently observed proliferating in and around bark beetle brood galleries, that one is led to suspect that they are responsible for much undetermined bark beetle mortality. There is a need for carefully isolating and identifying fungi where they appear to be deleterious to broods, and to determine the conditions necessary for them to become operative.

D. *Trypodendron lineatum* (Oliv.) Attacks in Living Trees.—This ambrosia beetle usually confines its attacks to recently dead trees, windfalls or logs. During the last five years, at least two cases of the beetles attacking living trees have been observed.

The first instance was where one end of a log highly attractive to beetles had been tied to a healthy hemlock. Attacks on the log were very heavy. In autumn, when the bark of the living tree was wet with rain, small pitch exudations could be seen on the outer bark. When the bark was removed, it was found that beetles had attempted to gain entry to the sapwood, but had only succeeded in penetrating to the cambium.

The other case occurred in a mature forest next to a logging setting where susceptible logs had been left during the spring attack period. In August, a standing, but suppressed hemlock was noted at the edge of the forest with many small pitch exudations on the lower five feet of its bole. *Trypodendron* had succeeded in penetrating into the wood to a depth of at least one-half inch, but no brood developed. The tree added its annual ring of xylem and succeeded in covering over all the entrance holes. Only dimples on the surface of the sapwood revealed where the beetles had entered.

In both of these cases, it appears that the beetles had been confused by the presence of highly attractive wood nearby. The resinosis is evidence that the species is not capable of coping with living trees. Even in recently cut logs and in windthrown trees, it has occasionally been observed that resin flow has thwarted successful attack. Although tropical ambrosia beetles attack, and sometimes kill healthy trees, there is little likelihood of our conifers succumbing to attacks by indigenous ambrosia beetles.

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DIMETHOATE, A SYSTEMIC OF LOW MAMMALIAN TOXICITY, AS AN ORCHARD INSECTICIDE IN BRITISH COLUMBIA[1]

D. P. PIELOU AND R. S. DOWNING[2]

Introduction

Until quite recently systemic insecticides have been of high, or moderately high, mammalian toxicity. Now systemics of low mammalian toxicity have been developed. Among these is dimethoate[3] (marketed in Europe as Rogor[4]), formerly known by the code numbers E. I. 12880 and NC 262 in Canada. The active ingredient is described chemically as *O,O*-Dimethyl *S*-(*N*-methylcarbamoylmethyl) phosphorodithioate, according to the nomenclature adopted by Martin (8). Discovery of the properties of the chemical appears to have been simultaneous and independent in the U. S. A. and in Europe. The available commercial products appear to be very similar (1, 5) in characteristics; however, formulation, and the actual industrial procedure of synthesis, may be different for the different products, and may lead to small differences in performance. Cyanamid dimethoate has been available as a 50 per cent wettable powder, and as an emulsifiable concentrate (46 per cent "solubilized liquid concentrate" containing four pounds active ingredient per U. S. gallon); Rogor as an emulsifiable concentrate containing 320 grams active ingredient per litre.

The acute oral toxicity (LD 50) of this compound to male rats is in the range 200 to 300 milligrams per kilogram of body weight. The corresponding range for dermal toxicity is 750 to 1,150 milligrams per kilogram (1, 5). The toxicity of the older systemic, demeton (*O,O*-Diethyl *O*-2 (ethylthio) ethyl phosphorodithioate) is approximately 60 times greater orally, and 10 times greater dermally, than that of dimethoate (6). The new material is comparable with DDT in so far as hazards to the operator are concerned. It is, for an insecticide, of unusually low toxicity to fish (5). In Canada, dimethoate has been registered for use on a number of non-bearing crops; and on bearing apples and pears, where a torenance of 2.0 parts per million has been established.

In our work at Summerland dimethoate has been tried aganst apple aphid, pear psylla and tetranychid mites; pests that have been difficult to control in recent years.

Control of Pear Psylla

The pear psylla, *Psylla pyricola* Foerst., after a quiescent period of many years (10) has once again come into prominence as a serious fruit pest in the Okanagan Valley. Resistance to malathion [*S*-(1,2-Dicarbethoxyethyl)-*O,O*-dimethyl phosphorodithioate] the recommended control material until 1958 (2), appears widespread (4). Difficulties, or failures in control, have been reported with other organo-phosphorus insecticides, and even with rotenone, once a widely recommended material.

In 1958 D. J. Marshall conducted some experiments in which he used dimethoate in two orchards. Dr. Marshall has allowed mention of his unpublished findings. In the orchards concerned, malathion, applied at 1½ pounds of 25 per cent wettable powder per 100 gallons[5], did not give satisfactory control. However, the two dimethoate liquid formulations (NC

[1] Contribution No. 48 from the Research Station, Canada Department of Agriculture, Summerland, British Columbia.

[2] Entomologists.

[3] Common name; originally coined by American Cyanamid Company, Stamford, Connecticut, U.S.A.

[4] Trademark of Montecatini, Rome, Italy. Distributed in Canada by Fisons (Canada) Limited, Toronto, Ont.

[5] Gallons are Imperial gallons except where otherwise indicated.

262 and 12880), applied at the rate of 32 ounces per 100 gallons, gave such promising results that it was decided, in 1959, to continue the work using lower rates of application.

The first trial in 1959 was carried out in an orchard of Bartlett pears on June 17. The trees were sprayed with a high-pressure (425 pounds per square inch), high-volume, gun sprayer. There were seven to ten trees per plot and two plots per treatment. Approximately seven gallons of dimethoate 46 per cent emulsion, diluted one pint per 100 gallon, were applied per tree. As a comparison, malathion was applied in similar amounts at a dilution of 1.5 pounds of 25 per cent wettable powder per 100 gallons. After the application, examinations of the leaves were made at intervals. Fifty leaves (10 from each of five central trees) were picked per plot and examined in the laboratory by stereomicroscope. Results are shown in Table 1.

TABLE 1—Effectiveness of dimethoate emulsion against pear psylla*

Treatment	Number of nymphs per 50 leaves				
Insecticide per 100 gal.	June 24	July 7	July 21	July 30	Aug. 10
Dimethoate, 1 pt.	33	10	22	32	110
Malathion, 1½ lb.	44	118		resprayed	
Check — no treatment	108	836**	9	5	61

* Treatment date, June 17.
** Sprayed with dimethoate, July 8.

Table 1 shows that dimethoate gave commercial control (an average of less than one nymph per leaf) for 43 days. Malathion gave commercial control for only seven days. The malathion plots were resprayed, with another experimental insecticide, when the average number of nymphs rose above two per leaf; the results of this spraying are not relevant to this investigation. On the check plots, after 20 days, the average number of nymphs per leaf was over 80 times that of the dimethoate plots and approximately 8 times that of the malathion plots. The latter fact indicates that although control with malathion was poor, total malathion-resistance had not been reached in this orchard. The check plots were subsequently sprayed with dimethoate and the results from this application confirmed the effectiveness of the material.

A second trial was carried out in an orchard of Bartlett, Bosc and Flemish pears on August 5. These applications were made with a concentrate airblast sprayer of the turbine axial-flow type. One gallon of 46 per cent emulsifiable dimethoate in 50 gallons of water was applied per acre; nozzle pressure was 300 pounds per square inch and the rate of travel 1.5 miles per hour, a recommended speed for the 20 x 20-foot planting. Evaluation of effectiveness was made as in the previous experiment; the results are shown in Table 2.

TABLE 2—Effectiveness of concentrate spraying against pear psylla*

Treatment	Number of nymphs per 50 leaves		
Insecticide per acre	Aug. 12	Aug. 21	Aug. 31
Dimethoate, 46%, 1 gal. in 50 gal. water	0	0	6
Check — no treatment	92	132	172

* Treatment date, Aug. 5.

It cannot be assumed, though it is probable, that the superior results obtained, compared with the previous experiment, were the result of concentrate spraying because of the differences in plant and insect development at the two dates; and because the temperature, at the time of application, was 10 °F. higher in the latter case. In this experiment some foliage injury was observed on the Bartlett variety but not on the other two varieties; about one-fifth of the foliage area was affected.

Since experience in British Columbia (9) is that wettable powders, in concentrate spraying, are less phytotoxic than emulsions, a third experiment was carried out in a Bartlett orchard. This trial was conducted later in the season, on October 2, when infestation was very high. Application was made with the air-blast concentrate sprayer as in the second trial; and conditions were approximately the same. Dimethoate 50 per cent wettable powder was applied at rates of 8 and 12 pounds per acre, the checks received no treatment. There were seven to ten trees per plot and two treatments per plot. Because insect numbers were high, evaluation was made using the "mite-brushing" technique (7), which proved to be applicable to psyllids. In view of the stage of the season, a single evaluation of results on October 9 was judged sufficient. At that date nymph counts averaged zero per 50 leaves at the 12 pound rate of application and two per 50 leaves at the 8 pound rate. On the check plots the average was 532 per 50 leaves. No foliar damage was observed. In other work (4) on pear psylla, dimethoate proved at least the equal of any other new material being tested.

Control of the European Red Mite

Resistance to various organo-phosphorus materials is common throughout the Okanagan Valley (3) in the European red mite, *Panonychus ulmi* (Koch). Though dimethoate is such a compound it was nevertheless deemed advisable to check its efficiency against this pest. Experiments were carried out in an orchard of semi-dwarf Red Delicious apples. Mites were sampled by the brush method (7) and, before spray application, averaged 12.3 mites per leaf in the orchard. Applications of insecticide were made on June 26 by high-pressure (420 p.s.i.) gun sprayer; approximately four gallons of spray fluid were used on each tree. There were three trees per plot and three replications per treatment. Results are shown in Table 3.

TABLE 3—Dimethoate and malathion against resistant European red mite*

Treatment	Average number mites per leaf	
Dilute application	July 3	July 9
Dimethoate, 0.05% active	5.7	27.0
Malathion, 0.05% active	11.0	30.3
Check — no treatment	24.3	41.6

* Treatment date, June 26.

Control of Reinfestation by Apple Aphid

Although both dimethoate, and malathion, treatments showed a significant reduction of mites after seven days, as compared with the check, the reduction was quite insufficient to constitute commercial control. Moreover, after 13 days, populations were not significantly lower than on the check plots. It was concluded that resistance to organophosphorus materials will preclude recommendation of dimethoate as a miticide in the Okanagan Valley. Experiments with mites were, therefore, terminated at this point.

By Spray Application

The current problem in the control of apple aphid, *Aphis pomi* DeG., is not so much that of the immediate effectiveness of freshly deposited insecticides on the insects, but of the effectiveness of residual deposits in the prevention of reinfestation from outside sources (13). It is a common occurrence, when sprays are applied against this sphid, for an efficient aphicide to give complete kill (11, 12) but for reinfestation to occur as the result of recolonization, by winged forms, from neighboring trees or orchards. A true persistent effect of an aphicide can be demonstrated only if invaders are given the opportunity of recolonizing aphid-free, but sprayed, trees; there is then no question that newly observed aphids originated from outside sources and are not the survivors, or offspring of survivors of indifferent spraying.

The experiments were carried out in 1958 in an orchard of dwarf (Malling *IX* rootstack) apple trees, approximately seven feet high, planted five feet apart, and in rows ten feet from each other. Two rows, of varieties Golden Delicious and McIntosh, were kept free of aphids, up to the time of the experiment, by repeated spraying with nicotine. Alternate rows were left untreated, as a source of infestation; and a high population of aphids developed on these. Plots of trees in the *aphid-free* rows (three trees per plot, two plot replications for each variety) were sprayed on July 7 with dimethoate emulsifiable concentrate, one pint per 100 gallons. Subsequently observations were made on the five subterminal leaves (omitting the terminal "bud") of tagged twigs. Five twigs were tagged per tree. Aphids were counted on both dorsal and ventral leaf surfaces, and the leaves left undisturbed till the next count. Tests showed that there was no error in counting up to 40 aphids per leaf, an error of + 3 up to 70 per leaf and an error of + 6 up to 100 per leaf. In numbers above 100 per leaf, aphids were estimated by counting the numbers in one part of the leaf and then judging what fraction this was of the whole population on the leaf. Counts on all trees, on all plots, were made 3, 7, 14, 17, 22, 25 and 31 days after application. Though there were generally more aphids on the more distal leaves of the group of five, figures were pooled to give a mean value per leaf. Comparison is made with the results for Sevin (*N*-Methyl-1-naphthyl carbamate), an efficient residual aphicide of the non-systemic type (13), applied at the rate of one pound 50 per cent wettable powder per 100 gallons. The results obtained are shown in Table 4.

TABLE 4—Recolonization of aphid-free apple leaves; means aphids per leaf

Treatment and variety	Days after application							
	0	3	7	14	17	22	25	31
Dimethoate Golden D.	0.00	0.10	0.10	0.50	0.40	0.56	0.46	1.90
McIntosh	0.00	0.08	0.30	0.00	0.00	0.00	0.14	0.71
Sevin Golden D.	0.00	0.10	0.34	1.10	0.91	4.41	16.40	15.20
McIntosh	0.00	0.06	1.44	0.71	1.20	2.66	13.80	18.90
No treatment Golden D.	0.00	16.40	39.30	115.00	106.00	118.00	350.00	220.00
McIntosh	0.00	13.90	31.00	28.00	49.10	38.10	160.00	80.80

This table shows that Sevin gave a highly significant reduction over the check after 31 days. However, good commercial control (indicated on the basis of field experience as a mean of one aphid per leaf) was evident for only 17 days. Dimethoate was significantly better than Sevin from the seventh day onward, and good commercial control was evident up to 31 days. In these experiments dimethoate therefore performed almost twice as well as Sevin. The method of evaluation ignored the

cluster of aphids in the terminal "bud" of the twig as these are not easy to count in the field. In a further evaluation, six such buds per tree were removed, from each tree in each plot, 33 days after application. They were placed in alcohol and the aphids counted later. The results of these counts, in aphids per bud, were as follows: checks, 151; Sevin, 29.9; dimethoate, 5.7. These figures confirm the superiority of dimethoate.

By Trunk Applications

Some years ago a limited experiment suggested that demeton might give effective aphid control when painted on the trunks of young trees early in the season (4). The possibility of such effective systemic action with dimethoate was therefore investigated. In the dwarf orchard described above, a row of 30 Red Delicious apple trees was selected. These trees had a trunk diameter of approximately 1½ inches. Individual trees were treated in randomized plots in three ways as described below.

(a) An average of 1.3 millitres of the emulsifiable concentrate was painted on the basal part of the stem of each tree with an artists' No. 10 brush. The trunks were painted all round, over a length of about six inches, approximately nine inches above the ground.

(b) First-aid medical "bandaids" were taken, and 0.3 millitres of concentrate applied to the pad of the bandaid. Four such bandaids were then arranged around the trunk of the tree approximately nine inches above the ground but below the first branch. Each tree therefore received 1.2 millitres of concentrate. The bandaids were completely covered with polythene film and the film secured to the trunk. The hypothesis behind the use of the bandaids was that a small, but continuous, supply of systemic would be available to the tree for a long period; and that, unlike the brush applications, the chemical would not tend to evaporate, or be washed away, by sprinkler irrigation water.

(c) Checks; these trees received no treatment.

The trunk applications were made on May 1. Aphid counts, on the five subterminal leaves of tagged twigs, were made directly in the field, as in the previous experiments, on June 3, July 4 and August 6. Results are shown in Table 5.

TABLE 5—Effectiveness of trunk application of dimethoate, applied May 1

Treatment	Mean number aphids per leaf		
	June 3	July 4	Aug. 6
In bandaids, 1.2 ml. per tree	0.31	0.92	1.91
By paint brush, 1.3 ml. per tree	0.69	1.21	154.00
Check — no treatment	10.33	45.70	170.50

It will be seen that bandaid applications gave commercial control for between two and three months; application by paint brush for between one and two months. However, if this procedure is adopted by growers for use on small trees or nursery stock, two applications by paint brush rather than one by bandaid, may be more economical of time and labour.

Some bark damage was evident in trees that received either form of trunk application. However, these trees did not seem to suffer any lasting effects, and two years later were not obviously different in any way from the check trees.

Summary

Dimethoate is a systemic insecticide of low mammalian toxicity and of great promise against fruit pests in the Okanagan Valley. Effective rates of spray application have been: one pint of emulsifiable concentrate per

100 gallons in dilute application; eight pounds of 50 per cent wettable powder per acre in air-blast application. Against the pear psylla, *Psylla pyricola* Foerst, dimethoate gave better, and more lasting, control than malathion. Against a strain of the European red mite, resistant to organophosphates, it did not provide commercial control, although it performed significantly better than malathion. In the persistence of its residual effects dimethoate was outstanding in preventing reinfestation of apple by apple aphid, *Aphis pomi* DeG. Here, under circumstances of severe reinfestation, commercial control by spray application was evident for four weeks; control was about twice as good as with Sevin, a relatively persistent non-systemic insecticide. Excellent control of aphids on young trees was obtained by painting small amounts of undiluted liquid concentrate, or by applying the concentrate in bandaids, to the lower parts of the trunks in May. In the former case effective control was apparent for one to two months; in the latter for two to three months. Trunk applications gave rise to a limited amount of bark injury that, however, did not prove to be permanent.

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NOTE ON PREDATION BY CALOSOMA FRIGIDUM KBY. ON OPEROPHTERA BRUCEATA HLST.

On June 2, 1959, eight miles west of Chetwynd (Little Prairie), B.C., a carabid, *Calosoma frigidum* Kby., was found preying upon the larvae of Bruce spanworm, *Operophtera bruceata* Hlst. Eighteen beetles were counted on the trunk and branches of ten trembling aspen trees. To gain its prey a carabid would start at the axis on the upper surface of a curled leaf, and using its mandibles, puncture the curled leaf tissue, driving the larva before it. When both beetle and larva reached the open end of the habitaculum the beetle would drop to the under side and seize the larva as it wriggled out. Neither rain nor wind seemed to deter the beetles' activity.

—T. A. D. Woods, Forest Biology Laboratory, Vernon, B.C.

CHEMICAL CONTROL OF LOOPERS IN STANLEY PARK, VANCOUVER[1]

G. T. SILVER[2]

Introduction

Stanley Park has long been recognized by the Forest Insect Survey as a good collecting area for loopers, primarily the western hemlock looper, *Lambdina fiscellaria lugubrosa* (Hlst.). A heavy outbreak of this species occurred between 1911 and 1913, but by 1914 the population was greatly reduced by the action of a tachinid fly (Whitford and Craig, 1918). Many western hemlock, *Tsuga heterophylla* (Raf.) Sarg., were killed outright. Another outbreak caused moderate defoliation in 1929, and the Park was dusted in 1930 to prevent further damage (Hopping, 1934).

No further outbreaks of the hemlock looper were recorded until 1958. In July, 1958, large numbers of hemlock loopers were present, but in association with a much larger number of green-striped forest looper, *Melanolophia imitata* Wlk. By July 15 the combined population has caused light to heavy defoliation on coniferous understory trees and light defoliation to many mature overstory hemlock. Six hundred acres were sprayed by aircraft on July 26 with 10 per cent DDT to protect the trees from further damage. No appraisal was made of insect mortality but about 30 minutes after spraying the roads and paths were littered with dead and dying larvae. Samples taken on the understory trees two days after spraying indicated a relatively large number of larvae had survived the treatment, apparently protected by the thick mid-story of vine maple which exists in some sections of the heavily wooded areas.

By mid-July, 1959, the numbers of western hemlock looper and the green-striped forest looper were large enough on some trees that if allowed to complete their feeding it was feared that top-kill could occur on some of the mature and over-mature western hemlock. In contrast to 1958 the hemlock looper was the more numerous species. About 550 acres were sprayed between 7:17 a.m. and 7:43 a.m., July 25, by a Grumman Avenger aircraft from Skyway Air Services Ltd. at Langley. The insecticide was DDT in fuel oil, without emulsifier, and applied at the rate of one gallon per acre.

Methods

Because of Park restrictions it was impossible to cut branch samples so larval mortality was calculated by a series of prepared tests. Larvae of both species were obtained by beating trees. Small hemlock branches were tied to a lath cross-piece suspended about a foot above a 40-inch square of factory cotton stretched on a frame. Tanglefoot was placed around the edge of the frame and the ends of the cross-piece to prevent larvae from escaping. The trays for the two species were set up in pairs in a large clearing with three replications about 200 feet apart at right angles to the line of flight. Larvae were placed on the foliage on the evening of July 24, and checked again early the next morning. The trays were checked four times after spraying on July 25, and once again early on July 26. All living larvae were then taken to the laboratory and reared for 11 days on foliage collected adjacent to each tray.

Spray deposit cards were set out on each tray prior to spraying, and samples of the insecticide were obtained.

Results

The insecticide samples were analysed by the Chemical Control Sec-

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tion, Forest Biology Division, and contained 7.54 per cent DDT by weight. The amount of DDT recovered from the spray deposit cards was small, ranging from 0.06 to 0.10 pounds per acre.

Considering the low DDT deposits hemlock looper larval mortality was remarkably heavy. In the three replications 0.06, 0.09, and 0.10 pounds of DDT per acre were recovered, and the corresponding larval mortality three days after spraying was 97.4, 90.4, and 96.8 per cent respectively. The combined mortality from the three replications is shown in Table 1. Mortality

TABLE 1—Hemlock looper larval mortality resulting from an average deposit of 0.083 lb./acre DDT. Stanley Park, 1959. Figures are uncorrected for natural mortality.

Date	Days after spray	No. larvae Dead	Living	Per cent mortality
July 26	1	197	19	91.2
July 27	2	199	17	92.1
July 28	3	204	12	94.4
July 30	5	206	10	95.4
July 31	6	207	9	95.8
August 3	9	209	7	96.8
August 6	12	209	7	96.8

was 91.2 per cent after 24 hours, and increased slowly to 96.8 per cent on the ninth day. Of the seven survivors after 12 days four were pupae.

Larval mortality of the green-striped forest looper was less than the hemlock looper. DDT recoverey in the three tests was 0.06, 0.09, and 0.10 pounds per acre, and larval mortality after three days was 75.8, 90.4, and 86.5 per cent respectively. Mortality in the first replication increased slowly, but reached 86.7 per cent on the twelfth day compared with 86.5 per cent for the test which received 0.09 pounds of DDT per acre. The data for the three replications were grouped (Table 2). Total mortality barely reached 90 per cent, considerably less than for hemlock looper. Twelve of

TABLE 2—Green-striped forest looper larval mortality resulting from an average deposit of 0.083 lb./acre DDT. Stanley Park, 1959. Figures are uncorrected for natural mortality.

Date	Days after spray	No. larvae Dead	Living	Per cent mortality
July 26	1	225	46	83.0
July 27	2	232	39	85.6
July 28	3	233	38	86.0
July 30	5	235	34[1]	87.4
August 3	9	237	32	88.1
August 4	10	238	31	88.5
August 6	12	240	27[2]	89.9

[1] 2 larvae missing.
[2] 2 larvae died of parasites.

the 27 survivors were pupae.

As material was not available to allow for check experiments the mortality percentages are not corrected for natural mortality.

On July 25, about 20 per cent of the hemlock loopers were in the fourth instar and about 80 per cent in the fifth or ultimate instar. Most of the fourth-instar larvae died within 24 hours. The first green-striped forest looper larvae to drop and die were the smallest. Dead larvae the first day were 23.5 per cent fourth, 52.5 per cent fifth, and 24.0 per cent sixth or ultimate instar. By the second day all fourth-instar larvae were dead, and after the fifth day only last-instar larvae were alive. Based on these records it appears that the best time to spray for both species is no later than when the majority of the larvae reach the fourth instar. In this particular instance treatment one week or 10 days earlier would have resulted in heavier mortality in a shorter time.

The hemlock looper appears to be the more susceptible of the two species of DDT. This difference may be associated with behaviour. When the hemlock looper larvae were set out for the tests in the evening they were extremly active, dropping from the foliage and trying to escape over the tanglefoot. This activity continued after spraying, thus exposing the larvae to more DDT as they moved over the foliage and across the trays. The green-striped forest looper larvae were more docile, tending to settle down on the foliage and remain stationary. Some larvae moved under the foliage and remained there, thus not being directly exposed to the insecticide.

As no further defoliation was observed after July 25, and no top-kill occurred, the control operation was considered a success.

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LIOCORIS SPP. COLLECTED ON ALFALFA IN CENTRAL AND NORTHERN BRITISH COLUMBIA

J. C. ARRAND[1]

During the summers of 1957-58 collections were made in alfalfa fields from Grand Forks through the Interior to as far north as Fort St. John, in the Peace River district. Identifications were made according to Kelton (1955):

Fort St. John, Taylor, Two Rivers—*Liocoris lineolaris, L. rufidorsus, L. borealis, L. unctuosis, L. elisus, L. nigrosignatus, L. solidaginis.*

Vanderhoof—*L. unctuosis, L. borealis, L. columbiensis.*

Smithers—*L. unctuosis.*

Vernon, Otter Lake, The Coldstream Valley—*L. lineolaris, L. rufidorsus, L. borealis, L. unctuosis, L. elisus, L. nigrosignatus.*

Grand Forks—*L. lineolaris, L. rufidorsus, L. borealis, L. unctuosis, L. nigrosignatus.*

Liocoris unctuosis, L. borealis, and *L. lineolaris* appear to be the most important species economically. One or more of these species generally made up the bulk of the "Lygus bug" population, although the relative abundance varied considerably.

It is interesting to note that in Kelton's (1955) distribution maps of *Liocoris* spp. in the prairies provinces, *L. nigrosignatus* is limited to the southern part of Alberta. Kelton does not record *L. elisus* from the northern areas of the prairies provinces, although he had examined specimens from the Yukon. *L. nigrosignatus* and *L. elisus* were commonly collected on alfalfa in the Peace River district.

[1] Kelton, L. A., 1955. Species of Lygus, Liocoris and their allies in the Prairie Provinces of Canada (Hemiptera: Miridae). Canadian Ent. 87: 511-556.

In Memoriam

WILLIAM DOWNES - 1874-1959

William Downes was born in Combe Raleigh, South Devon, England on October 13, 1874. His father, the Reverend W. Downes was an ardent botanist and an authority on the geology of the West of England. From him, and two elder brothers, Mr. Downes learned the elements of botany, geology, and entomology. All three men were keen entomologists with good collections.

He started school at Newton College in South Devon but on the death of his father, the family moved to Bristol where William went to Bristol Grammar School. Here there was ample opportunity for the study of natural science. Since there were no organized athletics nor even a proper playing field, he spent his free afternoons in the country searching for specimens. Besides entomology he studied the fresh water molluscs and acquired a considerable collection of them.

On leaving school Mr. Downes accepted an offer from his eldest brother to join him in New Zealand where he was established in sheep farming. After a year on his brother's place he worked for the Kiaora Sheep Farming Co. for two years, and subsequently purchased a property of his own. This was all bush land that had to be cleared and sown to grass, work that he let by contract. After six more years, he had cleared two-thirds of the land and established a flock of 1200 sheep. In 1901 he sold this farm and returned to England for nine months. Then he decided to visit Canada and spent one winter in Alberta. After having experienced the balmy New Zealand climate the Alberta winter gave him a poor opinion of the prairies and he left for British Columbia.

In May 1902 Mr. Downes purchased the J. Johns ranch near Armstrong, B.C., and for 14 years engaged in mixed farming. Because of ill-health, in the winter of 1915, he rented the ranch and moved to the coast. By the beginning of 1917 his health was greatly improved and he was employed to study the biology of the pear thrips by Dr. A. E. Cameron and Mr. R. C. Treherne, entomologists of the Canada Department of Agriculture, after they left the field station at Royal Oak near Victoria. The work was accomplished to the satisfaction of Dr. G. Hewitt, Dominion Entomologist and Mr. Downes was placed in charge of a new laboratory at Victoria in 1919 which position he held until his retirement in 1946. During this period he studied many insect pests of farm, garden, greenhouse, orchard, and dwelling. Some of his outstanding contributions were in the developing of control measures for root weevils, narcissus bulb fly, European earwig, cherry fruit-worm, pea leaf weevil, and apple sawfly.

His entomological zeal did not diminish after he retired for he continued to work on his insect collection, attend entomology meetings and publish papers. He received world recognition as a specialist in Hemiptera and had one of the finest collections of this order in North America. He donated the collection to the University of British Columbia two years before he died. In 1956 he enjoyed attending the Tenth International Congress of Entomology at Montreal where he saw many friends and coworkers in his field.

He was the author of many scientific papers and articles in systematic and applied entomology, 25 of them in our Proceedings. He was a rare, valuable combination of systematist and very practical economic entomologist. During his last 25 years he altered little in appearance or in keen mental alertness. His eyesight was failing somewhat but he still passed the annual driving test, and drove his car. He took good care of his health, believed in keeping busy at an unhurried pace and found time for his favorite diversions—snoozing after lunch, playing the stock market, salmon fishing, and gardening.

He was a member of the Entomological Societies of America, and Canada, and of the Professional Institute of the Public Service of Canada. His keen interest in our Society was reflected by his election to every office, and service on the executive

continuously from 1918 until his retirement. On retirement he was elected Honorary Life Member of the Society.

He is survived by his wife, the former Miriam Palmer at Victoria, and one daughter, Dorothy Halley at Texada Island, B.C.

—HARRY ANDISON.

INSTRUCTIONS TO CONTRIBUTORS

EDITORIAL COMMITTEE

Every journal should occasionally review its editorial policy and directions to contributors. The last time this was done for the *Proceedings* was about 1946, under the editorship of Hugh B. Leech. A clear understanding by authors of the requirements and a measure of uniformity help to shorten the time lag between the annual meeting and the publication date. Uniformity of presentation need not make for dullness, but it does make for efficiency, in that readers and abstractors can quickly find salient points. The presentation need not be without humor or individuality of expression, but it must be as simple and brief as possible and above all, clear.

Papers published in the *Proceedings* have not necessarily been delivered at the annual meeting, and papers delivered are not always published in the *Proceedings*. It is preferable, but not mandatory, that authors be members of the Society and contributions from amateurs are as welcome as those from professionals. Papers on almost any aspect of entomology are acceptable at the discretion of the Editorial Board, so long as they have some bearing on insects or pests of this Province.

Authors should understand that manuscripts will be scrutinized by the Editorial Board, and in certain cases may be submitted to outside reviewers at the Board's discretion; in these cases the author is given an opportunity to revise his paper in accordance with the reviewers' comments.

The maximum space allowed to one author per issue is 10 printed pages, i.e. about 25 pages of MS typed double spaced on 8½x11-inch paper. The cost of printing pages in excess of 10 must be borne by the author or his sponsoring institution, at a current rate of $10 per page. The price is subject to change.

Adherence to the following suggestions for preparing manuscripts will help to keep down costs by simplifying typesetting, and will minimize editorial revision.

Typing.—Use a fresh ribbon on one side of 8½x11-inch white bond. Submit the original and one clear carbon; retain a copy against possible loss. Double - space everything including quotations. Keep all margins at least 1-inch wide.

Title.—The shorter and more specific the better. Type in capitals. Identify organisms properly with author, taxonomic Order, and Family. Use a footnote to give a contribution number.

Author(s).—Give the initials and names only. Omit *By*. Centre and type in lower case. Use a footnote to give the location where the work was done or the sponsoring institution. The author's rank is not necessary, but if some details are desirable give these in a footnote.

Abstract or Summary.—Place at the end of the paper. Do not combine discussion and summary, and avoid numbered facts. The author is at an advantage if his summary can be used unchanged by abstracting organizations.

Footnotes.—Avoid them in the text wherever possible. Place a footnote between ruled lines immediately below the line of type in which the reference occurs. Use superscript numbers which run consecutively.

References.—Always put these at the end where they are easily found, not in brackets or footnotes. Arrange them alphabetically and number them. In the text make references consistently by number or by name and year. The preferred system of presentation is, in order: author's surname, and initials, year, title, name of publication, volume number in Arabic numerals, and pages. Junior author's initials precede the surname. The Chemical Abstracts system of abbreviations is to be used for journal names. A convenient list of several hundred Chem. Abstr. abbreviations, including Proc. Entomol. Soc. Brit. Columbia, is to be found in Can. J. Agr. Sci. 36: 513-519, 1956. Keep capitals to a minimum in titles of papers, but titles of books should be capitalized.

Tables.—These should be kept to a minimum and made as simple as possible. With its caption, a table should be self explanatory. It should not reproduce information given in the text or illustrations, but each table should be referred to in the text, e.g. Table 3. Number them in arabic numerals. The word TABLE should be capitalized in the caption. Do not use vertical lines. Small text tables, to fit in a single column without a caption, can often substitute for formal numbered tables. For taxonomic keys do not use progressive indentation.

Illustrations. — Line drawings are much cheaper to print and reproduce better than photographs. They should be on good quality white paper or light blue graph paper, and the author should bear in mind the probable reduction in choosing the thickness of lines; about 50 per cent is a good figure to bear in mind. This point is more critical in taxonomic illustration than it is in graphs. In a graph, the line of a curve must be heavier than the lines of the axes. Avoid more than 2 or 3 curves on a single graph. Photographs must be glossy prints with good contrast. Write clearly the author, title of paper, and Fig. number on the back of all illustrative material. Type the legends double-spaced on a separate sheet, each prefaced by its appropriate Fig. number. Legends must not be a part of the text. Indicate where the illustrations are to go in the paper.

Underlining.—Only words to appear in italics should be underlined.

Chemicals. — Describe clearly and specifically materials under discussion and identify them chemically. Give the source of supply in such a way that the work may be repeated. Put this information in a footnote so as not to break the continuity, unless there is a long list when it may form part of the text. In reporting dosages the concentration of active ingredient should be given. Common insecticides should be identified and then referred to in accordance with the published lists of the Committee on Insecticide Terminology of the Entomological Society of America.

Species names. — Proper names of insects and plants, with authors, are to be used at least once in the text of every manuscript, preferably at the first mention of the organism. For common and pest species use the names in the list published by the Entomological Society of America. These rules are made because the *Proceedings* finds its way to many foreign countries so that correct scientific usage becomes important.

Place names.—These must appear in, and the spelling agree with, the B.C. Gazetteer. If there is the slightest doubt look them up. The editors have had to do this for authors repeatedly, especially in distribution

lists where the information has come from badly made labels.

Proofs. — Galley proofs will normally be sent to authors, who should initial each sheet to indicate that it was read and approved. Use standard proofreaders marks in correcting, but do not hesitate to supplement them by writing clearly in the margins using a ball point pen. The aim is not uniformity of marks but absolute clarity for the typesetter.

Reprints. — Reprint policy is the same as that of the Canadian Entomological Society, whose schedule is reproduced:

Number of pages	1-4	5-8	9-12	13-16	17-20	21-24
First hundred copies	$22	$31	$42	$55	$70	$87
Additional hundreds	6	8	10	12	14	16

Abbreviations.—There are no hard and fast rules, but most situations will be covered by the following: Use periods for abbreviations. Do not add *s* for plurals. Per cent should be written in the text, and the sign, %, used in tables. Numbers should preferably appear as numerals, including 1 to 10. A good list of acceptable abbreviations is found on the 2nd page of any of Vol. 50 (1960), of Phytopathology.

THE BROWN DOG-TICK, RHIPICEPHALUS SANGUINEUS (LATR.) IN VANCOUVER

In summer, 1958 a veterinary surgeon in Vancouver sent me 3 ticks which he had removed from a Boxer dog whose past history he did not know. I sent the ticks to Mr. J. D. Gregson at Kamloops, the Canadian authority on ticks, who identified them as *Rhipicephalus sanguineus* Latr., the brown dog tick and warned me about its capacity for carrying disease. This was apparently the first western Canadian record of this species.

The last week in October 1959, another veterinary surgeon brought me some nymphal ticks and one engorged female which he had removed from a miniature poodle; I identified them as the brown dog tick and promptly got in touch with the owner of the poodle, to get its history. She told me that she had obtained a first poodle from California in early spring 1959 but the animal was not healthy and died in 3 or 4 months. She therefore imported another dog from the same stock in June and when this one also showed signs of sickness by October, she took it to the veterinarian since, as she said, she was tired of picking ticks off a sick dog. She told me that from the animal itself, from its padded sleeping basket, from the walls of the closet where the animal slept and from the wall-to-wall carpet in the bedroom, she had picked up and washed down the toilet at least one hundred ticks, many of them engorged females: even halving this number, gives a heavy infestation. I searched the penthouse where the people lived and obtained 1 engorged female, 16 male and 33 female nymphs averaging 3 to 3.3 mm. in length, a total of 50 ticks.

Of this tick, Gregson[1] says, "... this cosmopolitan species . . is potentially dangerous. Although normally a parasite of dogs, it may bite man and because of his close association with dogs there are frequent opportunities for the transmission of disease to him. In the Old World it is the vector of boutonneuse fever amongst dogs and man. It also transmits canine piroplasmosis which is not only present

in Europe, Asia and Africa but has also been found in the southern United States, Panama and Brazil (Cooley, 1946a). This tick is moreover, suspected of being able to transmit Rocky Mountain spotted fever and is considered to be an important vector of this disease in Mexico (Varela and Ortiz, 1949). Miller (1947) cites it as being capable of transmitting at least 11 diseases of man and animals."

I felt certain that the poodle that died and the one I investigated, suffered from canine piroplasmosis, so the owner's husband who is a medical doctor, treated the poodle himself accorded to standard methods recommended for this disease, and the animal recovered completely. They then telephoned my findings to the kennels in California where these poodles were bred and the breeders reported later that they had searched the premises and had found ticks swarming over the entire house and kennels and their dogs to be very sick. They therefore had the place fumigated and all the dogs inoculated for piroplasmosis and latest reports showed all animals to have recovered.

Warning notices about this tick are being sent to all veterinary surgeons in the Vancouver area.

[1] Gregson, John D., 1956. The Ixodoidea of Canada. Pub. 930, Science Service, Entomology Division, Canada Dept. of Agr., Ottawa.

—*G. J. Spencer, University of British Columbia, Vancouver.*

References

1. Gregson, John D. 1956. The Ixodoidea of Canada. Pub. 930, Science Service, Entomology Division, Canada Dept. of Agr., Ottawa.

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